APPENDIX A

Site Characteristics for Selected USGS Gage Stations in the Piedmont Physiographic Province

This Appendix provides summaries of field data collected by the U.S. Fish and Wildlife Service (Service) at twenty-three U.S. Geological Survey (USGS) gage station monitored stream sites in the Piedmont hydro-physiographic region of Maryland. Survey methods are presented in Appendix B *Protocols for field surveys at gage stations*.

Of the twenty-three sites surveyed, eighteen stations were active at the time of the survey. For three sites (Basin Run at Liberty Grove, Baisman Run at Broadmoor, Slade Run near Glyndon, and Northeast Creek at Leslie), the USGS revised the existing rating table prior to survey work. At most sites, a study reach was surveyed up- or downstream of the gage station to meet site selection criteria although in some cases, the gage reach is contained within the study reach.

For each site, information and survey data is summarized on four pages. The first page for each site contains general information on the drainage basin, gage station, and the study reach. The Maryland State Highway Administration provided land use/land cover information using the software program *GIS Hydro* (Ragan 1991) and 1994 Landsat and Spot coverages. Stream order and magnitude are based on Strahler (1964) and Shreve (1967), respectively. The reported discharge recurrence intervals are from the log-Pearson type III flood frequency distribution for the annual maximum series calculated by USGS according to the WRC Bulletin 17B procedures. The second page provides information on the study reach including cross-section plots and particle size distributions in the riffle and reach. The third page shows photographic views of the surveyed cross-section in the study reach and the fourth page provides a scale plan form diagram of the study reach mapped using a total station survey instrument and generated with the graphic and survey reduction software *Terra model*.

Interagency Advisory Committee on Water Data. 1982. Guidelines for determining flood flow frequency. Water Resources Council Bulletin 17B, 28 pp.

Ragan, R. M. 1991. A geographic information system to support state-wide hydrologic and nonpoint pollution modeling. Department of Civil Engineering, University of Maryland, College Park, MD.

Shreve, R.L. 1967. Infinite topologically random channel networks. Journal of Geology, 75: 178-86.

Strahler, A. N. 1964. Geology. Part II. Quantitative geomorphology of drainage basins and channel networks, in Handbook of Applied Hydrology (Ed. V.T. Chow), pp. 4-39 to 4-76, McGraw-Hill, New York.

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BAISMAN RUN AT BROADMOOR, MD
USGS STATION NUMBER: 1583580

Latitude:	39º 28' 45"	Gage Period of Record:	1964 – 1969
Longitude:	76º 40' 42"		1970 – 1976
ADC Map Coordinates:	Baltimore / 1993		1999 - Present
	Map 18 / C5	Mean Annual Discharge (cfs):	1.85
Drainage Area (sq. mi.):	1.47	Rosgen Stream Type:	C4
Stream Order / Magnitude:	2 / 2	Survey Date:	Oct. 1998
Percent Imperviousness:	4.25		

Land Use (%): Residential: 16.98 Agricultural: 4.72 Forest: 75.47 Commercial: 0.00

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 4.8 (sys) $Q_{1.5}$: 96.00 $Q_{2.0}$: 136.70
(Log-Pearson Period: 1965 – 1976, 1999)

General Study Reach Description: The study reach and gage reach are the same and located at a temporary gage location downstream while the bridge was under construction. The reach has pool/riffle morphology, a regular meander pattern with minor depositional features and some lateral scour, and appears vertically stable. The upstream end of the reach is ditched, and the lower end lies within a former backwater zone of a now destroyed dam or weir that can be seen downstream of the study reach. There are no large woody debris or boulders in the reach. The bank vegetation is mostly grass, with a few scattered trees and a bamboo stand at the downstream limit of the study reach. Floodplain vegetation is also mostly grass, with a lawn on the right and a pasture on the left.

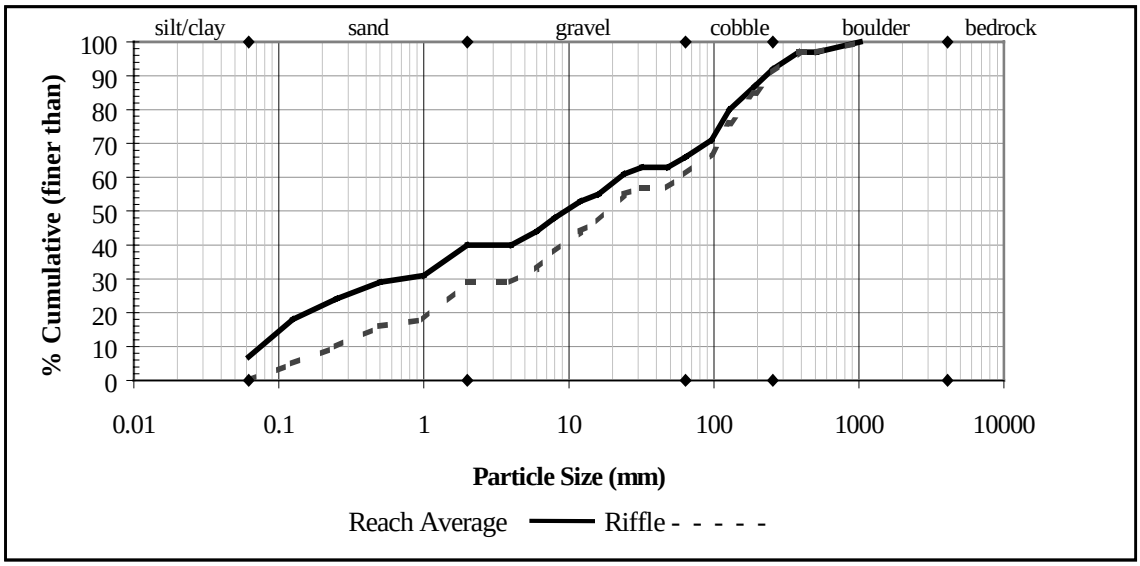
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	114.50	Q_{bkf} / $Q_{2.0}$:	0.84	
Bankfull Return Interval (R.I.):	1.55	$Q_{Top\ of\ Bank}$(cfs):	357.50	R.I.: 7.30
Gage Height (ft):	3.13	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	1.19			

STUDY REACH SURVEY INFORMATION

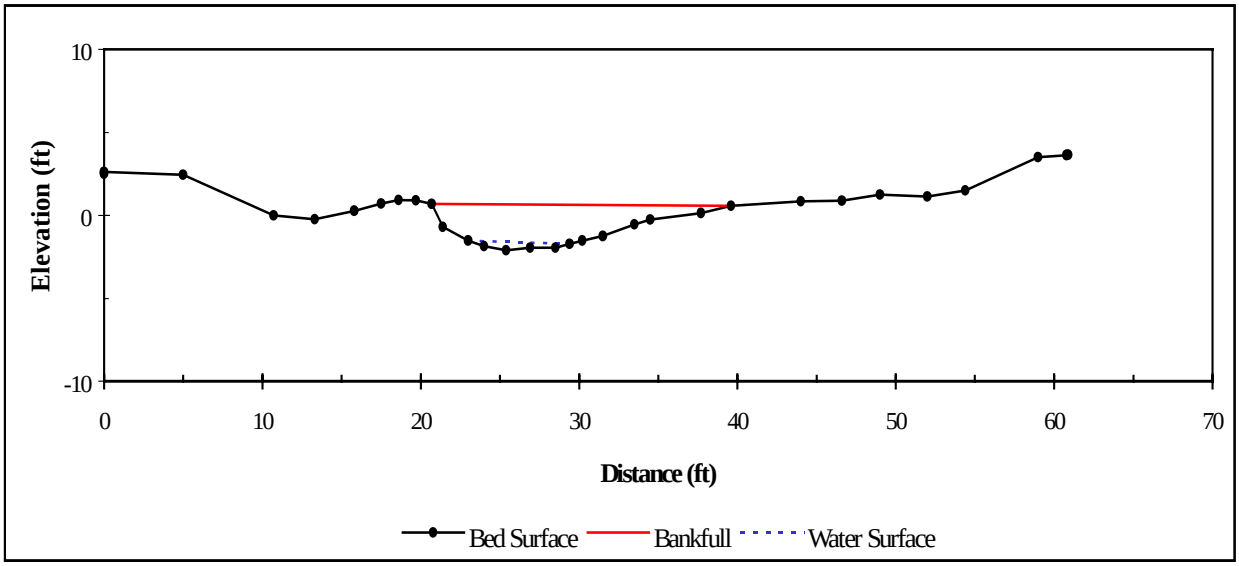
Average Water Surface Slope (ft/ft):	0.0160	Flood-prone Width (ft):	458.00
Manning's "n":	0.069	Entrenchment Ratio:	24.23
Mean Bankfull Velocity (ft/sec):	3.66	Width/Depth Ratio:	11.39
u/u*:	4.11	Channel Sinuosity:	1.29
R/D_{84}:	2.54	Beltwidth:	84
Froude Number:	0.50	Meander Width Ratio:	4.4

BAISMAN RUN AT BROADMOOR, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	0.11	0.49
D_{35}	1.34	6.60
D_{50}	9.47	18.49
D_{84}	160.05	184.87
D_{95}	314.60	336.59

STUDY REACH CROSS SECTION



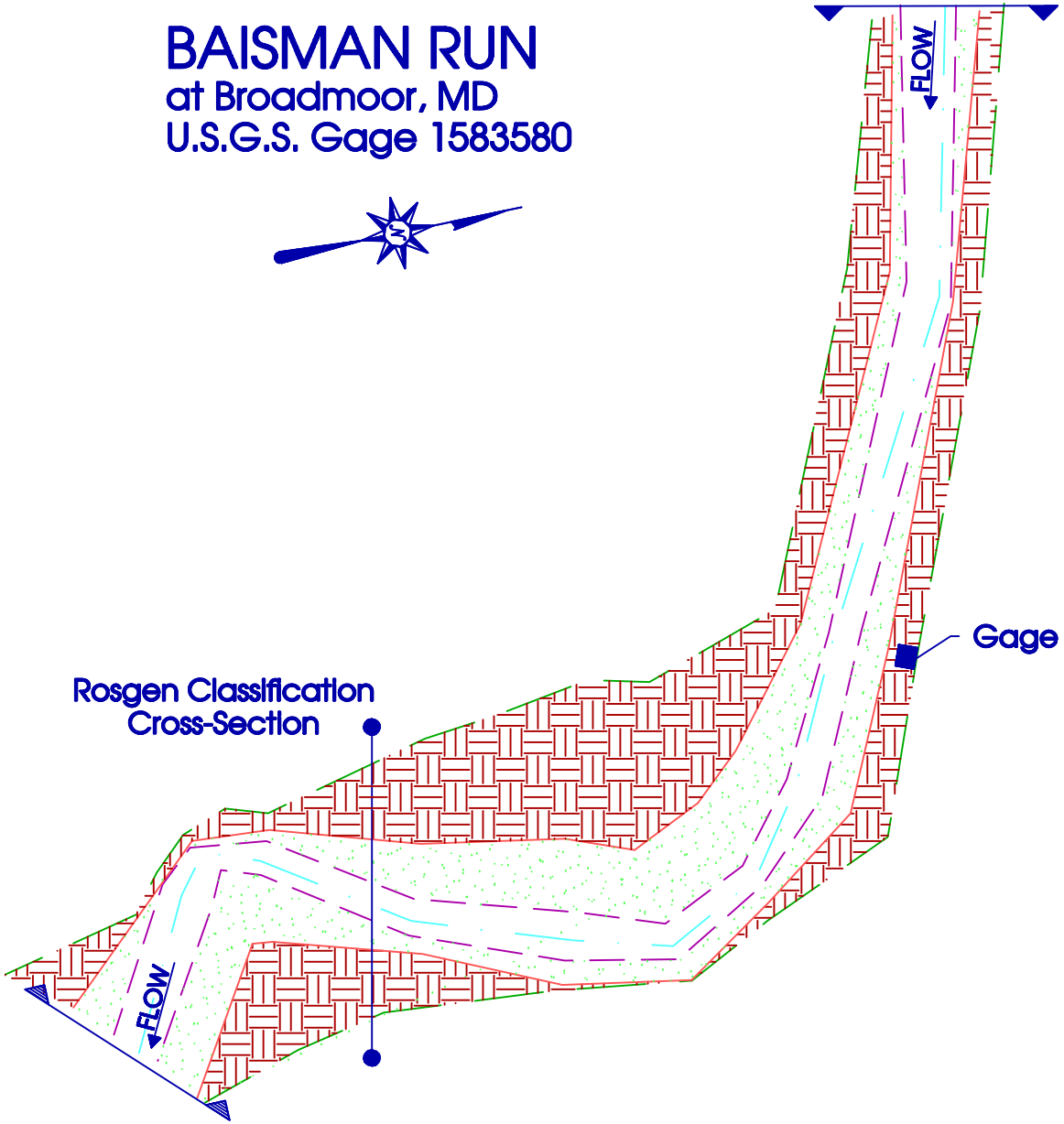
Bankfull Width (ft):	18.90	Mean Bankfull Depth (ft):	1.66
Bankfull Cross-sectional Area (ft^2):	31.32	Maximum Bankfull Depth (ft):	2.77
Hydraulic Radius (ft):	1.54	Wetted Perimeter (ft):	20.34

Baisman Run at Broadmoor, Maryland

Downstream view of classification cross-section

Right bank of classification cross-section

BAISMAN RUN
at Broadmoor, MD
U.S.G.S. Gage 1583580



LEGEND

Top of Bank :

Bankfull :

Edge of Water :

Thalweg :

Earth :

Sand/Gravel :

Limit of Study Reach:

Scale (ft): 0 25 50 100

Survey Date: 11/16/98
Study Reach Length: 310'

Classification Cross-Section Monument Locations:
Left Monument Location (+/- 20'):
39* 28' 44.67" N
76* 40' 37.33" W
Elevation: 339'

Right Monument Location (+/-20'):
39* 28' 44.94" N
76* 40' 38.10" W
Elevation: 302'

BASIN RUN AT LIBERTY GROVE, MD
USGS STATION NUMBER: 1579000

Latitude:	39º 39' 30"	Gage Period of Record:	1948 - 1958
Longitude:	76º 06' 10"		1965 - 1976
ADC Map Coordinates:	Cecil / 1989	Mean Annual Discharge (cfs):	6.74
	Map 3 / B12	Rosgen Stream Type:	C4
Drainage Area (sq. mi.):	5.31	Survey Date:	Oct. 1998
Stream Order / Magnitude:	3 / 9		
Percent Imperviousness:	6.79		

Land Use (%): Residential: 13.78 Agricultural: 63.35 Forest: 18.89 Commercial: 3.97

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 155.60 $Q_{1.5}$: 580.00 $Q_{2.0}$: 808.70
(Log-Pearson Period: 1949 - 1976)

General Study Reach Description: The study reach and the gage reach are the same. The channel exhibits pool/riffle morphology, a regular meander pattern with well-vegetated point bars and some lateral scour, and appears vertically stable. A cut-off channel at one meander has produced a mid-channel island, and another meander has been stabilized with rubble. The overall particle distribution is bi-modal sand and gravel. There are no pieces of large woody debris or boulders in the channel. The reach is in a pasture, and cattle have unrestricted access to the stream. The bank and floodplain vegetation is pasture grass and scattered trees, mostly sycamores.

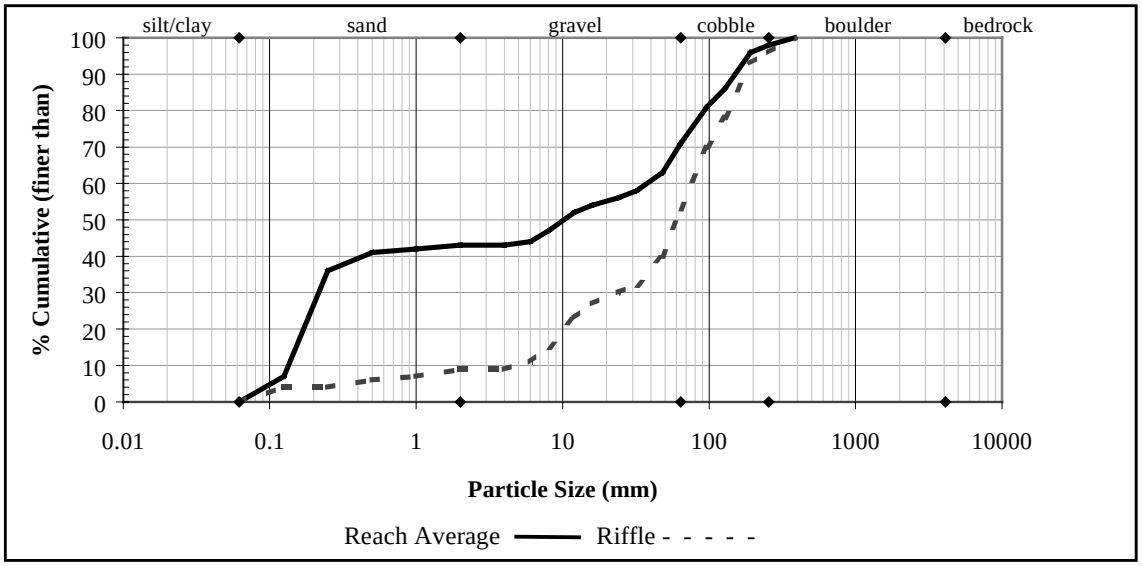
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	613.92	Q_{bkf} / $Q_{2.0}$:	0.76	
Bankfull Return Interval (R.I.):	1.55	$Q_{Top\ of\ Bank}$(cfs):	1179.50	R.I.: 3.20
Gage Height (ft):	3.55	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	1.06			

STUDY REACH SURVEY INFORMATION

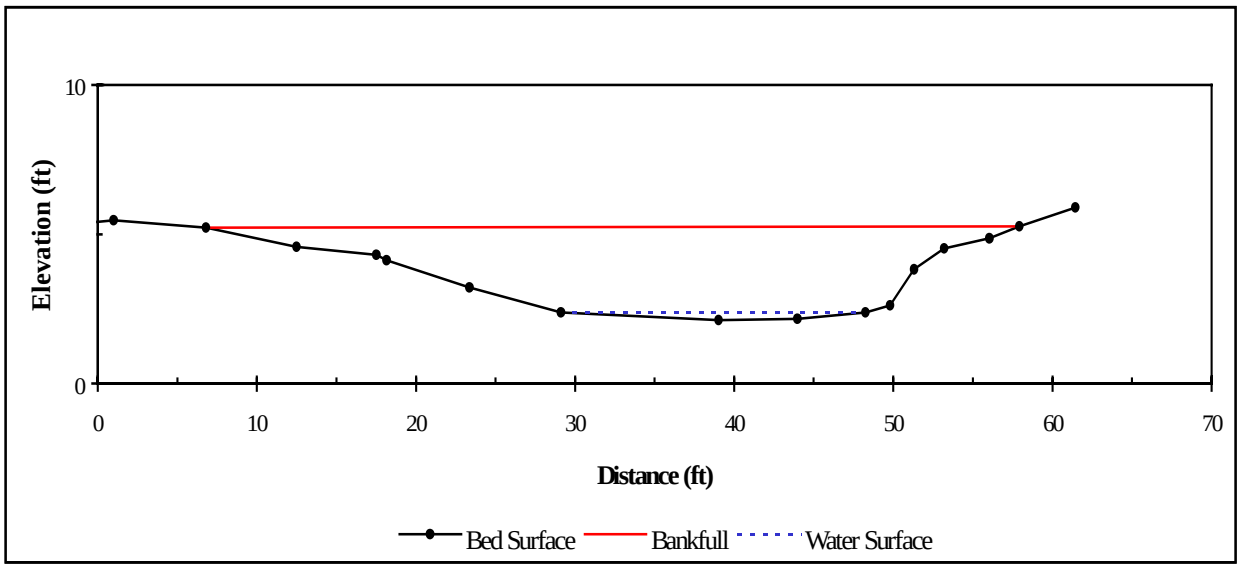
Average Water Surface Slope (ft/ft):	0.0059	Flood-prone Width (ft):	360.00
Manning's "n":	0.050	Entrenchment Ratio:	7.04
Mean Bankfull Velocity (ft/sec):	6.34	Width/Depth Ratio:	27.04
u/u*:	5.82	Channel Sinuosity:	1.40
R/D_{84}:	3.77	Beltwidth:	96
Froude Number:	0.81	Meander Width Ratio:	1.9

BASIN RUN AT LIBERTY GROVE, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	0.16	8.42
D_{35}	0.24	37.25
D_{50}	10.31	59.89
D_{84}	112.46	150.54
D_{95}	186.88	232.59

STUDY REACH CROSS SECTION

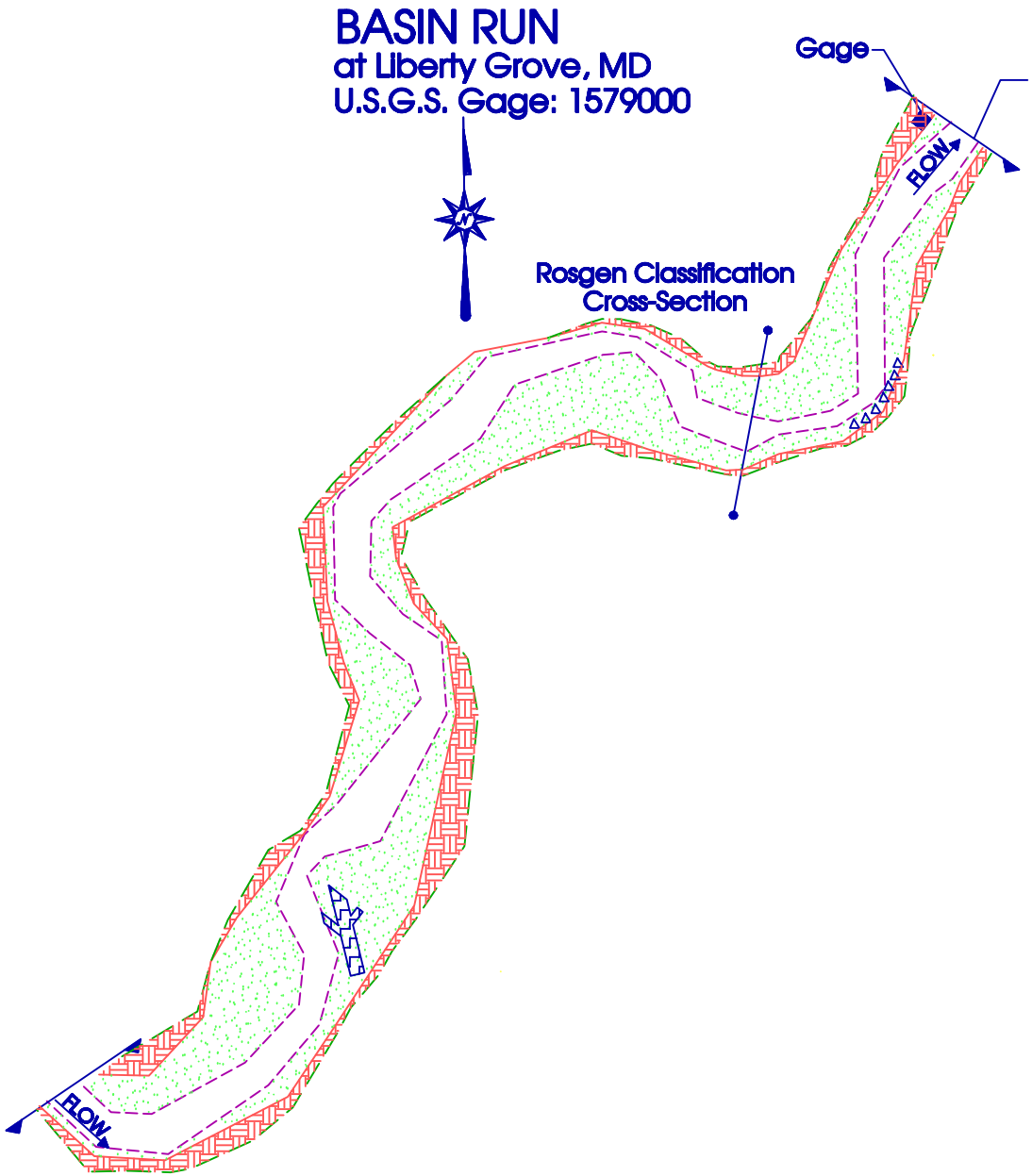


Bankfull Width (ft):	51.11	Mean Bankfull Depth (ft):	1.89
Bankfull Cross-sectional Area (ft^2):	96.83	Maximum Bankfull Depth (ft):	3.11
Hydraulic Radius (ft):	1.86	Wetted Perimeter (ft):	51.96

Basin Run at Liberty Grove, Maryland

Upstream view of classification cross-section

Right bank of classification cross-section



LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Rubble Rip-Rap:
- Fallen Trees :
- Limit of Study Reach:

Scale (ft): 0 50 100 200

Survey Date: 10/9/98
Study Reach Length: 980'

Classification Cross-Section Monument Locations:
Left Monument Location (+/-):
N/A
N/A
Elev. N/A

Right Monument Location (+/-):
N/A
N/A
Elev. N/A

BEAVER RUN NEAR FINKSBURG, MD
USGS STATION NUMBER: 1586210

Latitude:	39° 29' 22"	Gage Period of Record:	1982 - Present
Longitude:	76° 54' 12"	Mean Annual Discharge (cfs):	16.60
ADC Map Coordinates:	Carroll / 1994	Rosgen Stream Type:	C4/1
	Map 26 / A7	Survey Dates	Oct. 1997
Drainage Area (sq. mi.):	14.00		Sept. 1998
Stream Order / Magnitude:	3 / 30		
Percent Imperviousness:	8.59		

Land Use (%): Residential: 19.03 Agricultural: 51.32 Forest: 25.61 Commercial: 3.69

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 151.80 $Q_{1.5}$: 520.00 $Q_{2.0}$: 733.20
(Log-Pearson Period: 1983 - 1995)

General Study Reach Description: The downstream end of the study reach is 220 feet upstream of the gage. The study reach has pool/riffle features, a regular meander pattern controlled by bedrock with some gabion/rip-rap revetment along the road on a portion of the right bank. The reach exhibits a bi-modal distribution of gravel and bedrock with point- and side-bar depositional features, some lateral scour, and is vertically stable. The reach contains several pieces of large woody debris, one of which spans the channel, and numerous boulders. The bank vegetation is comprised of trees and sparse grass, while the floodplain vegetation is moderately dense forest of hickory, ash, tulip poplar, beech and oak, with a moderately dense understory of spice bush, witch hazel, and rhododendron.

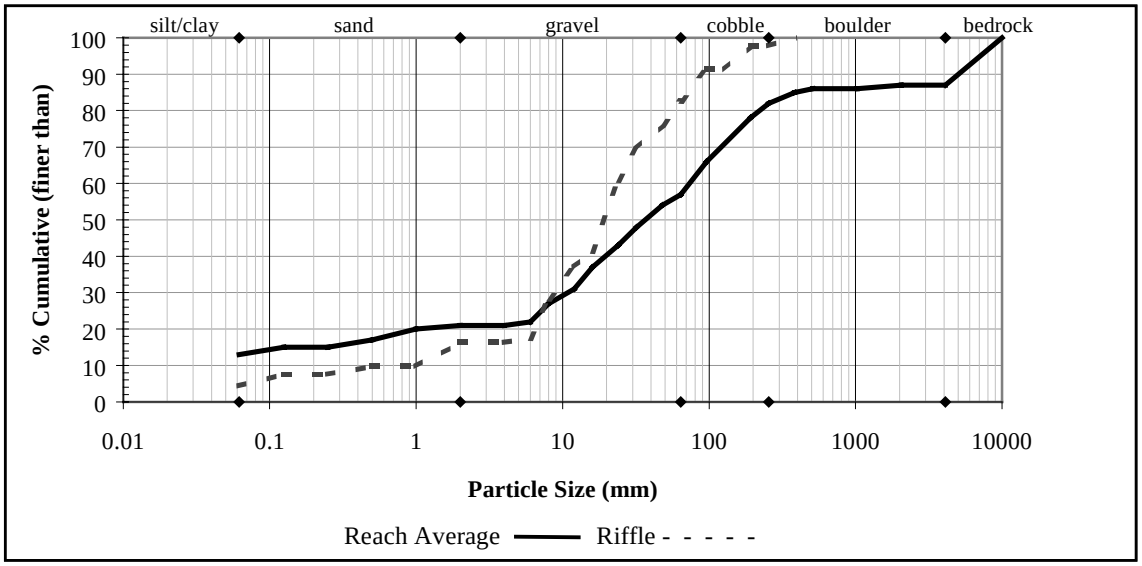
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	626.90	Q_{bkf} / $Q_{2.0}$:	0.86	
Bankfull Return Interval (R.I.):	1.73	$Q_{Top\ of\ Bank}$(cfs):	n/a	R.I.: n/a
Gage Height (ft):	3.61	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	1.21			

STUDY REACH SURVEY INFORMATION

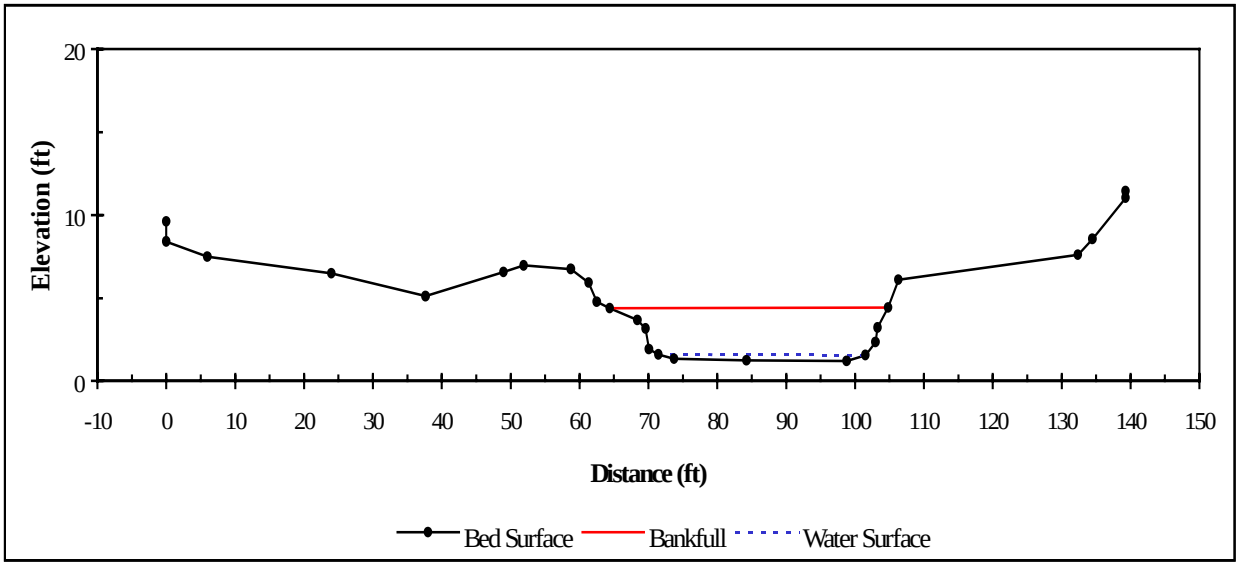
Average Water Surface Slope (ft/ft):	0.0050	Flood-prone Width (ft):	126.40
Manning's "n":	0.032	Entrenchment Ratio:	3.13
Mean Bankfull Velocity (ft/sec):	5.93	Width/Depth Ratio:	15.49
u/u*:	9.41	Channel Sinuosity:	1.06
R/D_{84}:	11.04	Beltwidth:	87
Froude Number:	0.65	Meander Width Ratio:	2.2

BEAVER RUN NEAR FINKSBURG, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	0.35	1.94
D_{35}	14.54	10.95
D_{50}	36.63	19.16
D_{84}	335.45	68.29
D_{95}	Bedrock	161.06

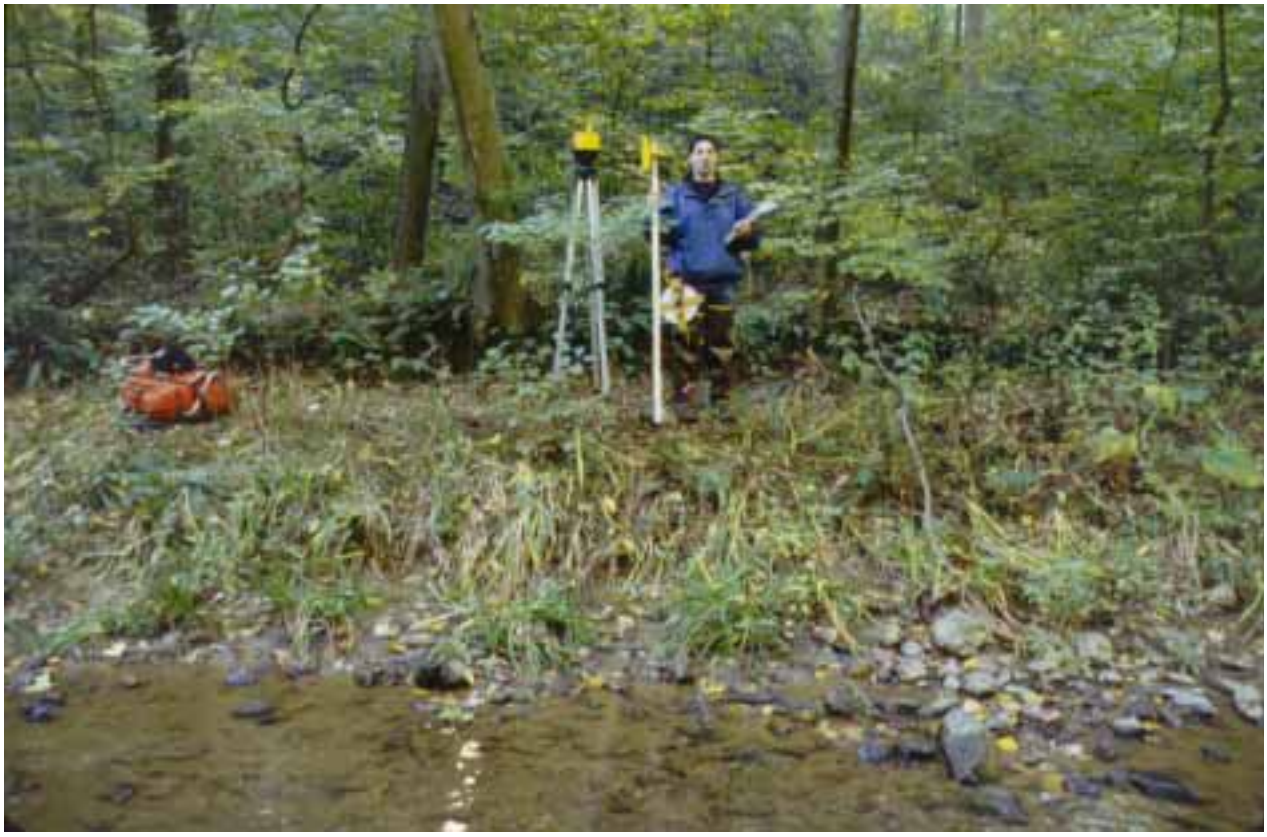
STUDY REACH CROSS SECTION



Bankfull Width (ft):	40.43	Bankfull Depth (ft):	2.61
Bankfull Cross-sectional Area (ft^2):	105.69	Maximum Bankfull Depth (ft):	3.20
Hydraulic Radius (ft):	2.47	Wetted Perimeter (ft):	42.74

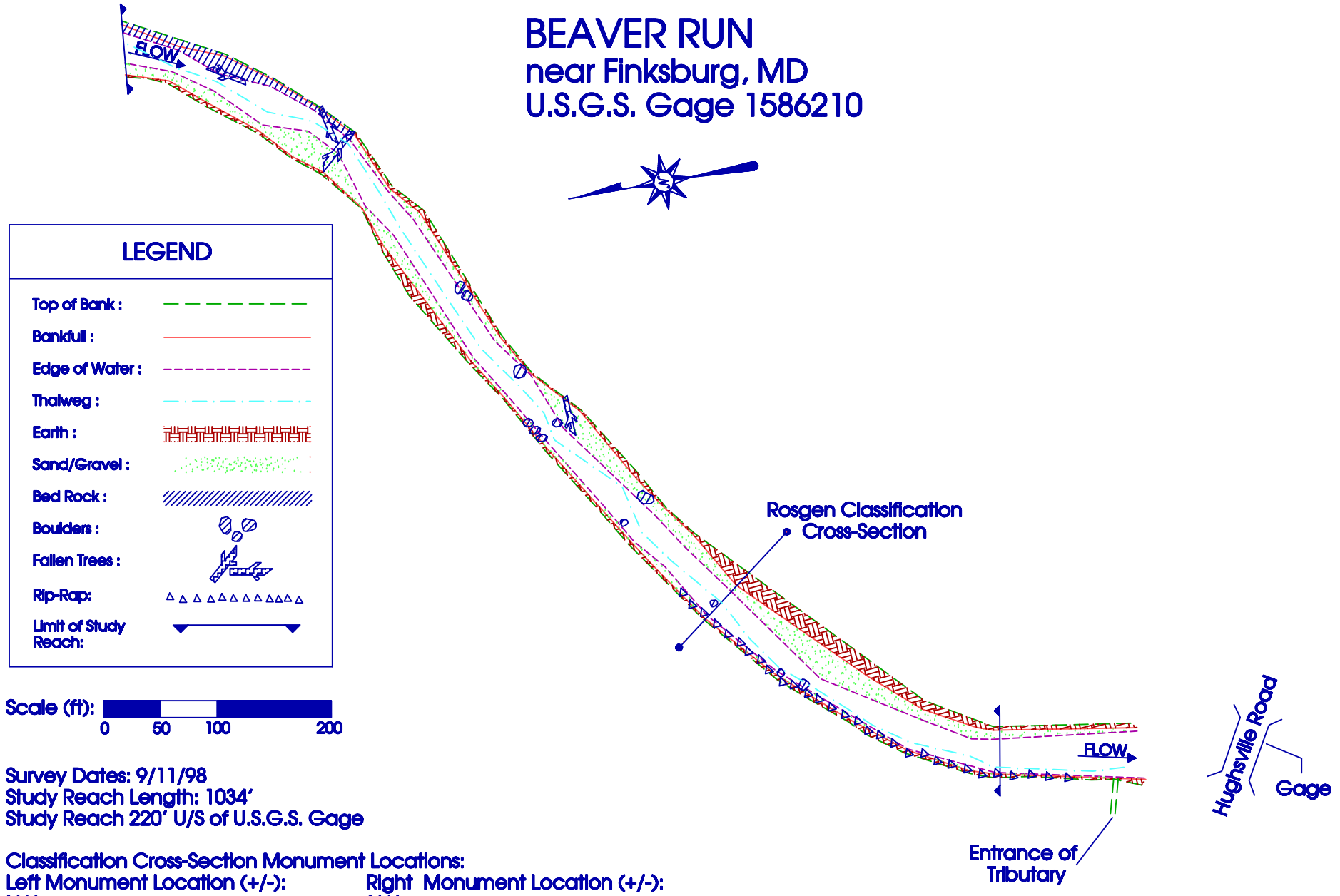
Beaver Run near Finksburg, Maryland

Upstream view of classification cross-section



Left bank of classification cross-section

BEAVER RUN
near Finksburg, MD
U.S.G.S. Gage 1586210



LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Bed Rock :
- Boulders :
- Fallen Trees :
- Rip-Rap:
- Limit of Study Reach:

Scale (ft): 0 50 100 200

Survey Dates: 9/11/98
Study Reach Length: 1034'
Study Reach 220' U/S of U.S.G.S. Gage

Classification Cross-Section Monument Locations:

Left Monument Location (+/-):	Right Monument Location (+/-):
N/A	N/A
N/A	N/A

BEAVERDAM RUN AT COCKEYSVILLE, MD
USGS STATION NUMBER: 1583600

Latitude:	39° 29' 13"	Gage Period of Record:	1982 - Present
Longitude:	76° 38' 42"	Mean Annual Discharge (cfs):	30.50
ADC Map Coordinates:	Baltimore / 1993	Rosgen Stream Type:	C5/1c-
	Map 18 / G-H 4	Survey Dates:	Oct. 1997
Drainage Area (sq. mi.):	20.90		Nov. 1998
Stream Order / Magnitude:	3 / 16		
Percent Imperviousness:	19.28		

Land Use (%): Residential: 28.67 Agricultural: 24.61 Forest: 30.91 Commercial: 11.30

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 341.80 $Q_{1.5}$: 800.00 $Q_{2.0}$: 997.60
(Log-Pearson Period: 1983 - 1995)

General Study Reach Description: The upstream end of the study reach is 600 feet downstream of the gage. The reach has pool/riffle features, a meander pattern that may have been straightened in the past and is partially controlled by bedrock, point- and side-bar depositional features, some lateral scour, and appears vertically stable. There are several pieces of large woody debris, two of which extend at least to mid-channel, and several boulders. The bank and floodplain vegetation consists of moderately dense young forest of ash, red maple, and sycamore, with a low-density understory of saplings and shrubs.

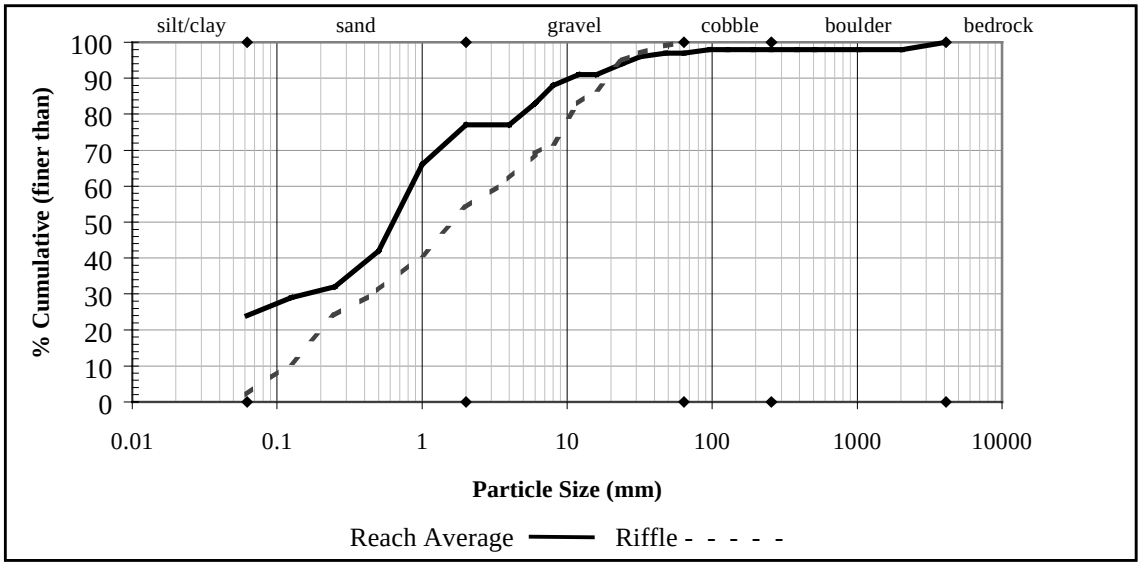
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	662.50	Q_{bkf} / $Q_{2.0}$:	0.66	
Bankfull Return Interval (R.I.):	1.26	$Q_{Top\ of\ Bank}$(cfs):	980.30	R.I.: 2.00
Gage Height (ft):	5.15	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	0.83			

STUDY REACH SURVEY INFORMATION

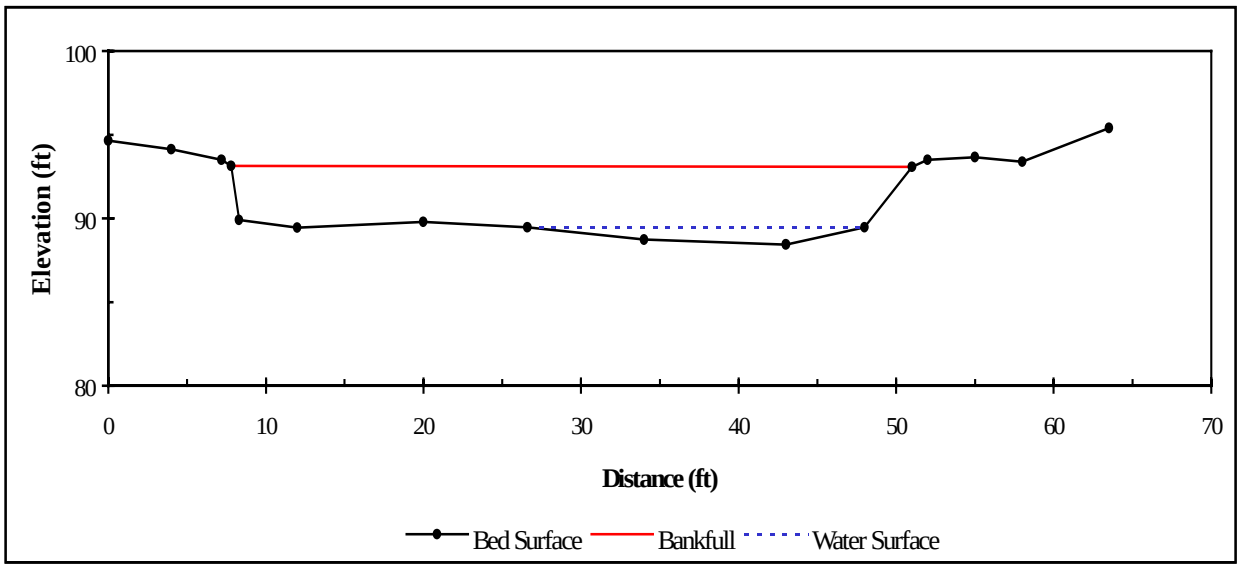
Average Water Surface Slope (ft/ft):	0.0008	Flood-prone Width (ft):	463.50
Manning's "n":	0.023	Entrenchment Ratio:	10.73
Mean Bankfull Velocity (ft/sec):	4.09	Width/Depth Ratio:	11.52
u/u*:	14.10	Channel Sinuosity:	1.13
R/D_{84}:	80.01	Beltwidth:	95
Froude Number:	0.37	Meander Width Ratio:	2.2

BEAVERDAM RUN AT COCKEYSVILLE, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	0.16
D_{35}	0.31	0.66
D_{50}	0.63	1.62
D_{84}	6.36	12.89
D_{95}	27.71	24.00

STUDY REACH CROSS SECTION



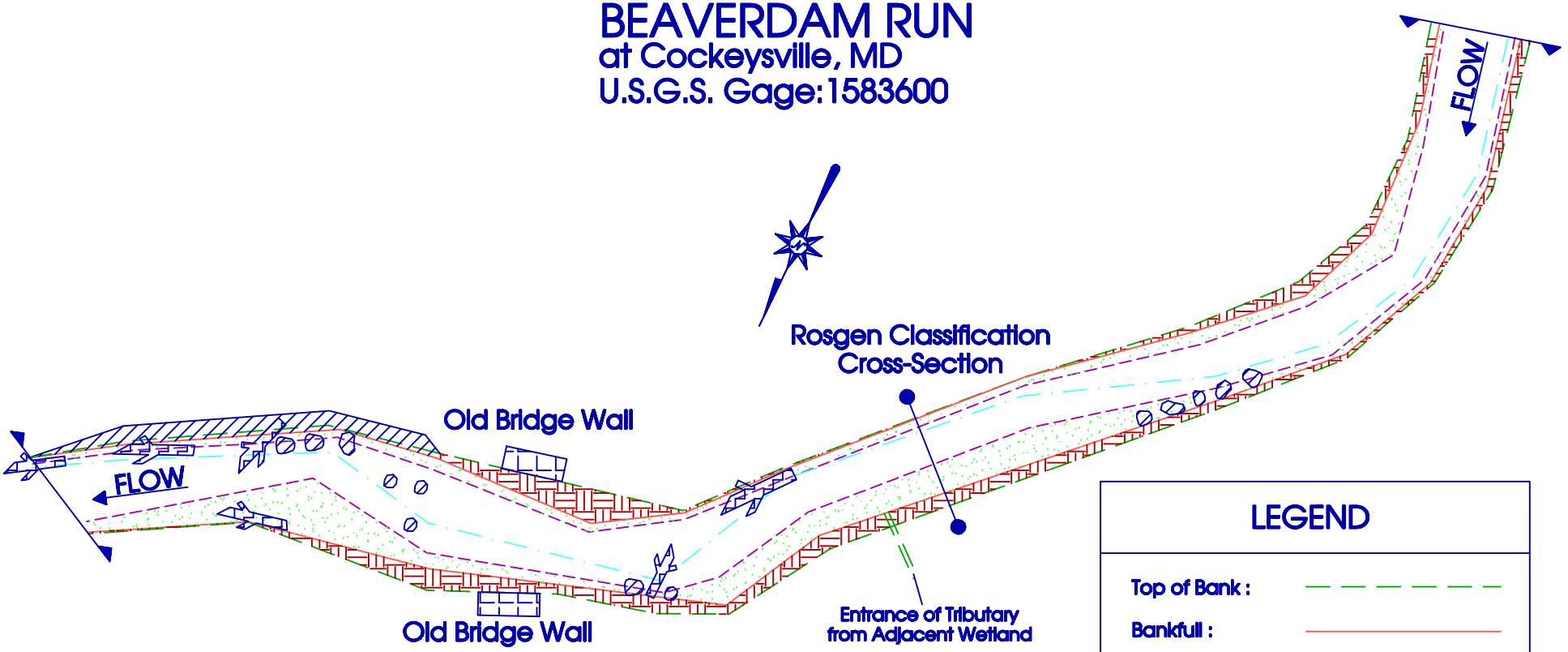
Bankfull Width (ft):	43.20	Bankfull Depth (ft):	3.75
Bankfull Cross-sectional Area (ft^2):	161.98	Maximum Bankfull Depth (ft):	4.69
Hydraulic Radius (ft):	3.38	Wetted Perimeter (ft):	47.87

Beaverdam Run at Cockeysville, Maryland

Downstream view of classification cross-section

Right bank of classification cross-section

BEAVERDAM RUN
at Cockeysville, MD
U.S.G.S. Gage:1583600



Scale (ft): 0 50 100 200

Survey Date: 11/17/98
Study Reach Length: 926'
Study Reach 600' D/S of U.S.G.S. Gage

LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Bed Rock :
- Boulders :
- Fallen Trees :
- Limit of Study Reach:

BENNETT CREEK AT PARK MILLS, MD
USGS STATION NUMBER: 1643500

Latitude:	39° 17' 40"	Gage Period of Record:	1948 – 1958
Longitude:	77° 24' 30"		1966 - Present
ADC Map Coordinates:	Frederick / 1992	Mean Annual Discharge (cfs):	70.70
	Map 45 / F - G2	Rosgen Stream Type:	C4/1
Drainage Area (sq. mi.):	62.80	Survey Dates:	Nov. 1997
Stream Order / Magnitude:	5 / 122		Feb. 1999
Percent Imperviousness:	3.48		

Land Use (%): Residential: 9.54 Agricultural: 51.69 Forest: 37.51 Commercial: 1.10

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 783.40 $Q_{1.5}$: 1800.00 $Q_{2.0}$: 2312.30
(Log-Pearson Period: 1949 – 1995)

General Study Reach Description: The downstream end of the study reach is 1,624 feet upstream of the gage, because the intervening section is a highly uniform run that may have been channelized in the past. The study reach channel has pool/riffle features, a fairly straight, bedrock-controlled, meander pattern with point- and side-bar depositional features, some lateral scour, and appears vertically stable. There are a few pieces of large woody debris along the banks of one riffle, and several large boulders are scattered throughout the reach. The bank and floodplain vegetation is moderately dense forest, consisting of beech, hemlock, oak and sycamore, with a low-density understory of saplings, spice bush, and mountain laurel.

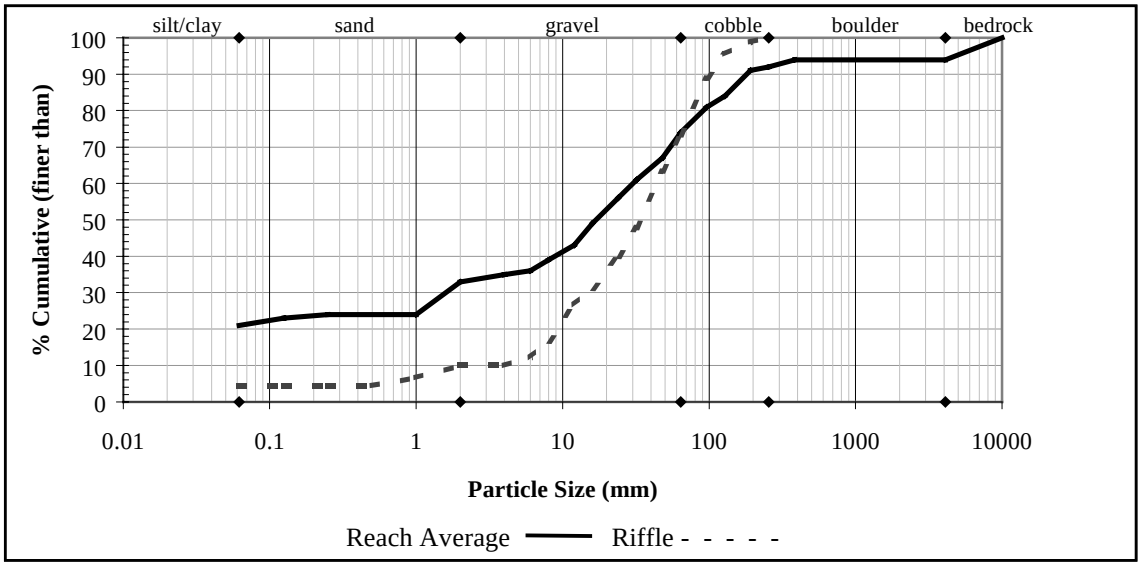
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	1867.00	Q_{bkf} / $Q_{2.0}$:	0.81	
Bankfull Return Interval (R.I.):	1.55	$Q_{Top\ of\ Bank}$(cfs):	n/a	R.I.: n/a
Gage Height (ft):	6.28	$Q_{Active\ Channel}$ (cfs):	214.80	R.I.: <1.005
Q_{bkf} / $Q_{1.5}$:	1.04			

STUDY REACH SURVEY INFORMATION

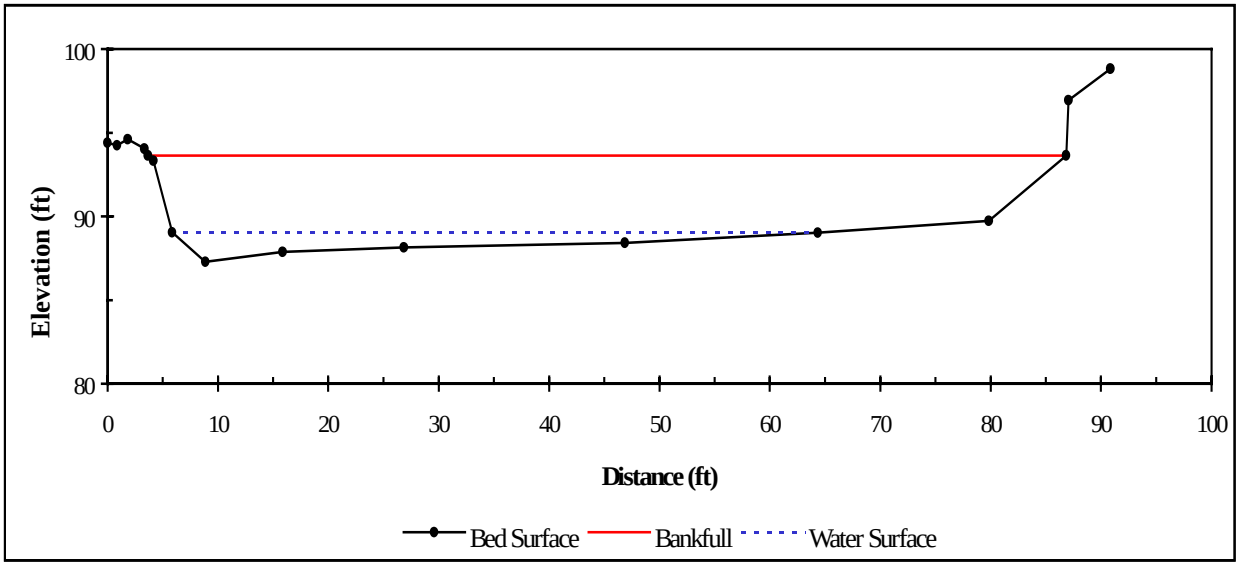
Average Water Surface Slope (ft/ft):	0.0019	Flood-prone Width (ft):	271.00
Manning's "n":	0.038	Entrenchment Ratio:	3.26
Mean Bankfull Velocity (ft/sec):	4.69	Width/Depth Ratio:	17.41
u/u*:	8.85	Channel Sinuosity:	1.11
R/D_{84}:	16.36	Beltwidth:	161
Froude Number:	0.38	Meander Width Ratio:	1.9

BENNETT CREEK AT PARK MILLS, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	7.66
D_{35}	4.00	19.11
D_{50}	16.95	33.91
D_{84}	128.00	84.51
D_{95}	Bedrock	124.97

STUDY REACH CROSS SECTION

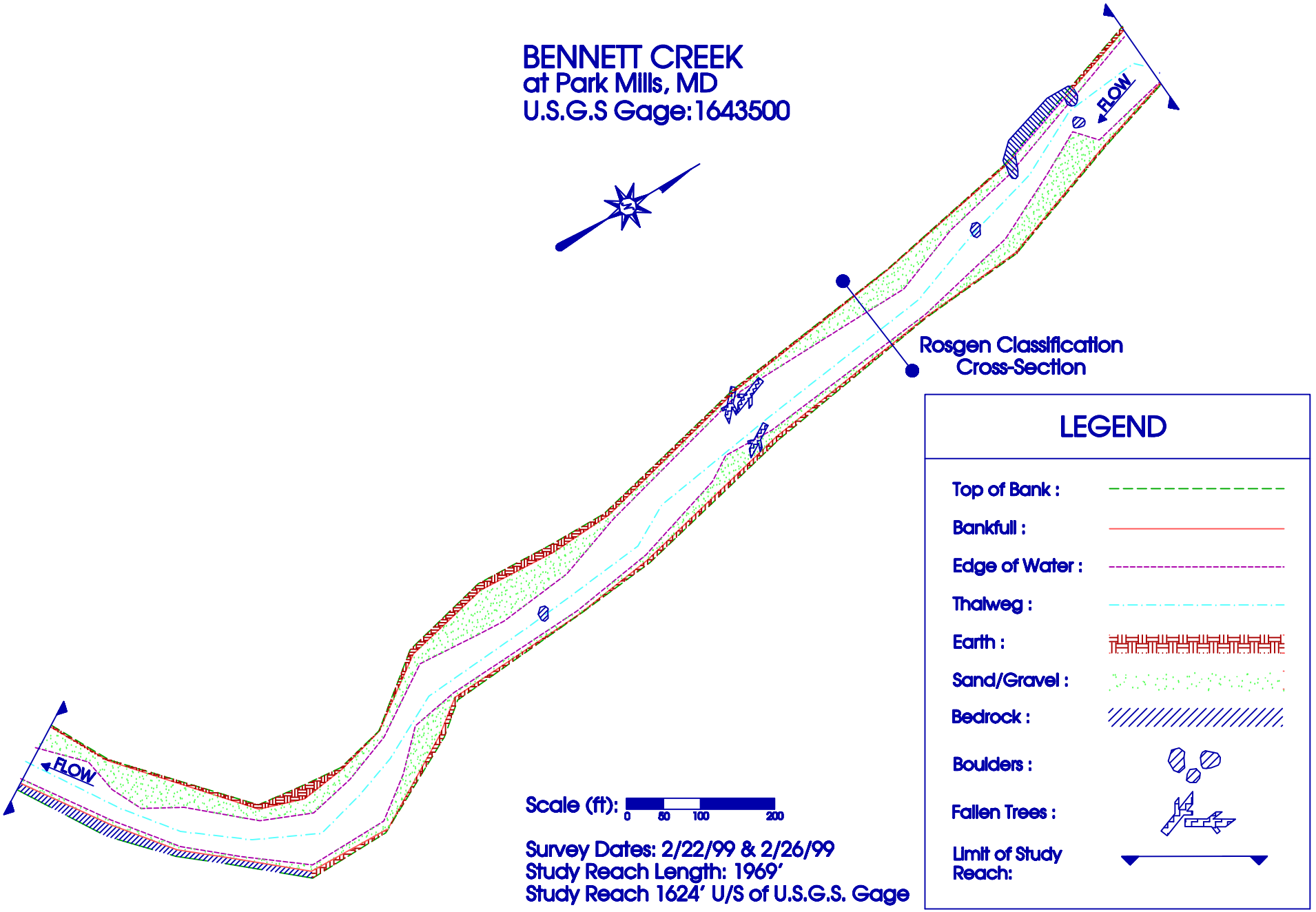


Bankfull Width (ft):	83.20	Mean Bankfull Depth (ft):	4.78
Bankfull Cross-sectional Area (ft^2):	398.03	Maximum Bankfull Depth (ft):	6.37
Hydraulic Radius (ft):	4.54	Wetted Perimeter (ft):	87.76

Bennett Creek at Park Mills, Maryland

Downstream view of classification cross-section

Left bank of classification cross-section


BENNETT CREEK
at Park Mills, MD
U.S.G.S Gage:1643500
FLOW
FLOW
Rosgen Classification
Cross-Section
LEGEND
Top of Bank :
Bankfull :
Edge of Water :
Thalweg :
Earth :
Sand/Gravel :
Bedrock :
Boulders :
Fallen Trees :
Limit of Study
Reach:
Scale (ft): 0 50 100 200
Survey Dates: 2/22/99 & 2/26/99
Study Reach Length: 1969'
Study Reach 1624' U/S of U.S.G.S. Gage

BIG ELK CREEK AT ELK MILLS, MD
USGS STATION NUMBER: 1495000

Latitude:	39° 39' 26"	Gage Period of Record:	1932 - Present
Longitude:	75° 49' 20"	Mean Annual Discharge (cfs):	69.40
ADC Map Coordinates:	Cecil / 1989	Rosgen Stream Type:	C4/1
	Map 7 / C - D12	Survey Dates:	Sept. 1997
Drainage Area (sq. mi.):	52.60		Aug. 2000
Stream Order / Magnitude:	4 / 67		
Percent Imperviousness:	4.05		

Land Use (%): Residential: 2.68 Agricultural: 76.69 Forest: 16.27 Commercial: 3.79

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 723.50 $Q_{1.5}$: 2200.00 $Q_{2.0}$: 2883.00
(Log-Pearson Period: 1984 – 2000)

General Study Reach Description: The upstream end of the study reach is 481 feet downstream of the gage, because the intervening reach is an atypically long and steep riffle. The study reach has pool/riffle features, a straight meander pattern with sidebars and low lateral scour. An active quarry operation on the left floodplain may have altered the channel alignment. Large woody debris is negligible, but large boulders are distributed through the reach. The vegetation on both banks is moderately dense forest, consisting of sycamore, red maple, alder and willow, with a dense understory of blackberry and multiflora rose. The quarry encroaches on the left floodplain, while the right floodplain is old field.

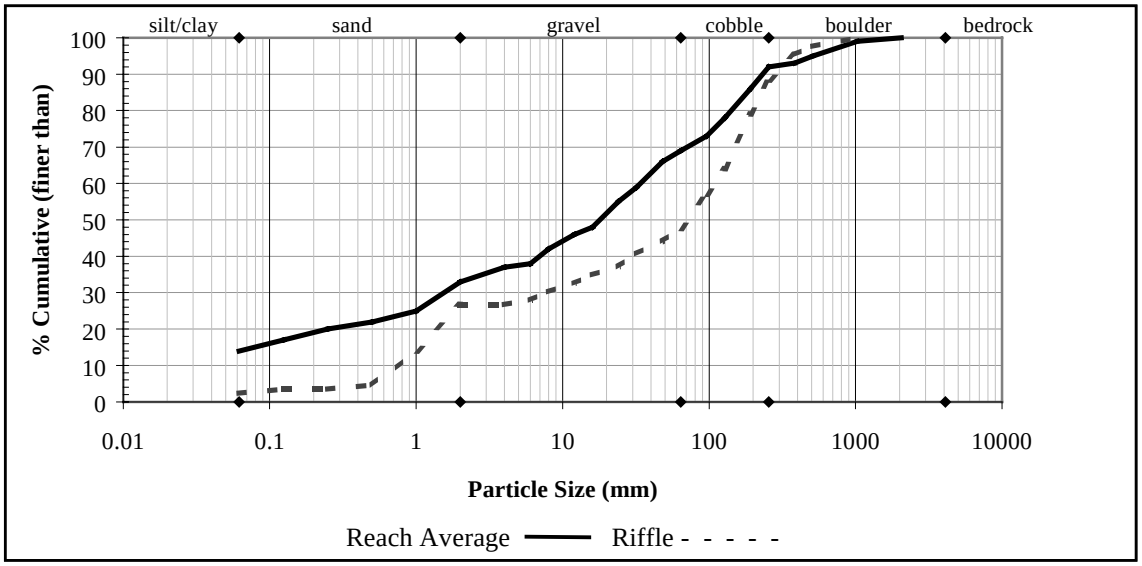
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	2099.00	Q_{bkf} / $Q_{2.0}$:	0.73	
Bankfull Return Interval (R.I.):	1.45	$Q_{Top\ of\ Bank}$(cfs):	5178.00	R.I.: 5.50
Gage Height (ft):	6.10	$Q_{Active\ Channel}$ (cfs):	742.30	R.I.: 1.01
Q_{bkf} / $Q_{1.5}$:	0.95			

STUDY REACH SURVEY INFORMATION

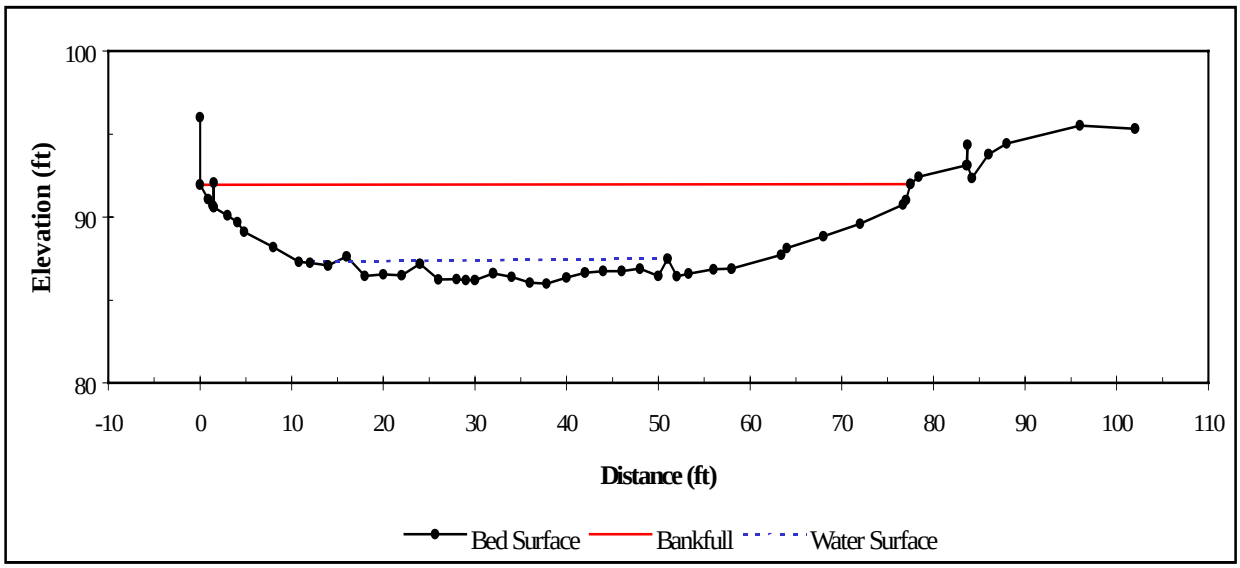
Average Water Surface Slope (ft/ft):	0.0014	Flood-prone Width (ft):	407.00
Manning's "n":	0.058	Entrenchment Ratio:	5.25
Mean Bankfull Velocity (ft/sec):	6.14	Width/Depth Ratio:	17.57
u/u*:	5.68	Channel Sinuosity:	1.04
R/D_{84}:	5.50	Beltwidth:	210
Froude Number:	0.52	Meander Width Ratio:	2.7

BIG ELK CREEK AT ELK MILLS, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	0.10	1.12
D_{35}	2.83	16.33
D_{50}	17.97	70.83
D_{84}	173.49	223.62
D_{95}	512.00	376.29

STUDY REACH CROSS SECTION



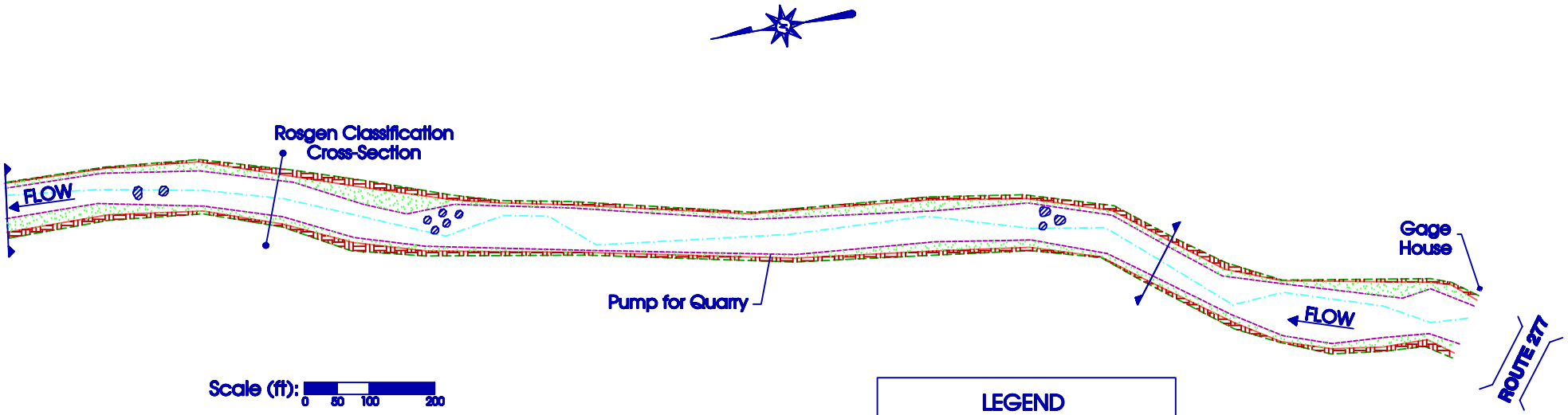
Bankfull Width (ft):	77.50	Mean Bankfull Depth (ft):	4.41
Bankfull Cross-sectional Area (ft^2):	341.70	Maximum Bankfull Depth (ft):	5.97
Hydraulic Radius (ft):	4.04	Wetted Perimeter (ft):	84.63

Big Elk Creek at Elk Mills, Maryland

Upstream view of classification cross-section

Right bank of classification cross-section

BIG ELK CREEK
at Elk Mills, MD
U.S.G.S. Gage 1495000



Scale (ft): 0 50 100 200

Survey Dates: 1/13/99 & 1/14/99
Study Reach Length: 1808'
Study Reach 487' D/S of U.S.G.S. Gage

Classification Cross-Section Monument Locations:
Left Monument Location (+/-):
N/A
N/A
Elev. N/A

Right Monument Location (+/-16'):
39°39'08.06" N
75°49'23.96" W
Elev. 75'

LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Boulders :
- Fallen Trees :
- Limit of Study Reach:

BIG PIPE CREEK AT BRUCEVILLE, MD
USGS STATION NUMBER: 1639500

Latitude:	39° 36' 45"	Gage Period of Record:	1947 - Present
Longitude:	77° 14' 10"	Mean Annual Discharge (cfs):	115.00
ADC Map Coordinates:	Carroll / 1994	Rosgen Stream Type:	C4/1
	Map 9 / A 10-11	Survey Dates:	Nov. 1997
Drainage Area (sq. mi.):	102.00		Feb. 1999
Stream Order / Magnitude:	4 / 170		
Percent Imperviousness:	3.54		

Land Use (%): Residential: 9.49 Agricultural: 66.52 Forest: 22.29 Commercial: 1.31

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 1327.60 $Q_{1.5}$: 2600.00 $Q_{2.0}$: 3266.00
(Log-Pearson Period: 1948 - 1995)

General Study Reach Description: The upstream end of the study reach is 244 feet downstream of the gage. The channel has pool/riffle features, a bedrock-controlled meander pattern, point- and side-bar depositional features, some lateral scour, and is stabilized vertically by bedrock outcrops. There are several pieces of large woody debris distributed through the reach, one spans the full channel width. Numerous boulders occur in the lower third of the reach. The bank vegetation is moderately dense trees consisting of sycamore, red maple and oak, while the floodplain vegetation is a mix of pasture, cropland, and moderately dense forest with a low-density understory of shrubs and saplings.

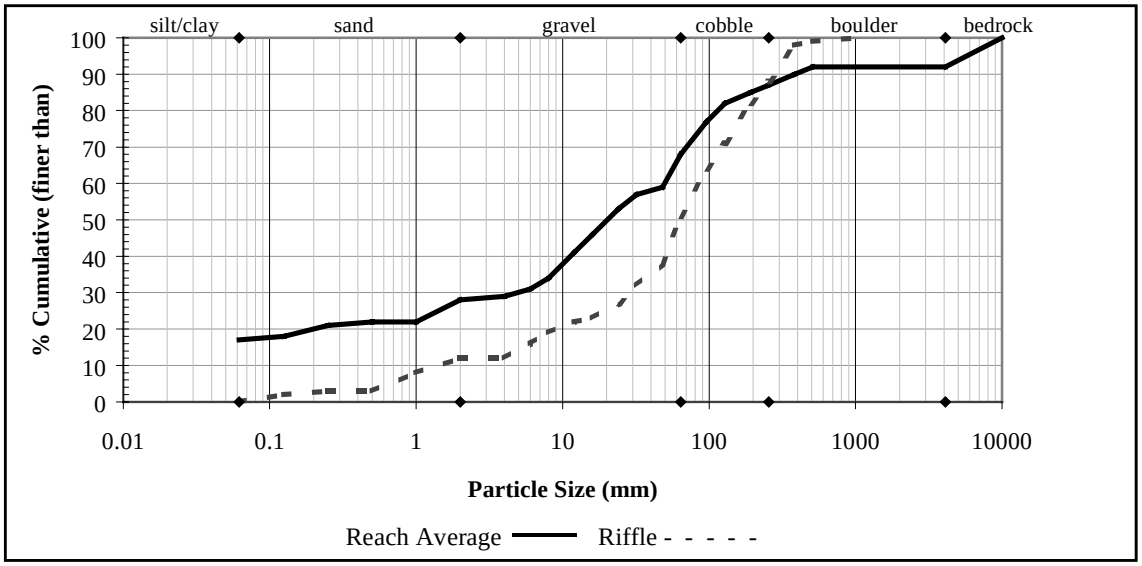
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	2658.00	Q_{bkf} / $Q_{2.0}$:	0.81	
Bankfull Return Interval (R.I.):	1.55	$Q_{Top\ of\ Bank}$(cfs):	n/a	R.I.: n/a
Gage Height (ft):	7.20	$Q_{Active\ Channel}$ (cfs):	1945.00	R.I.: 1.15
Q_{bkf} / $Q_{1.5}$:	1.02			

STUDY REACH SURVEY INFORMATION

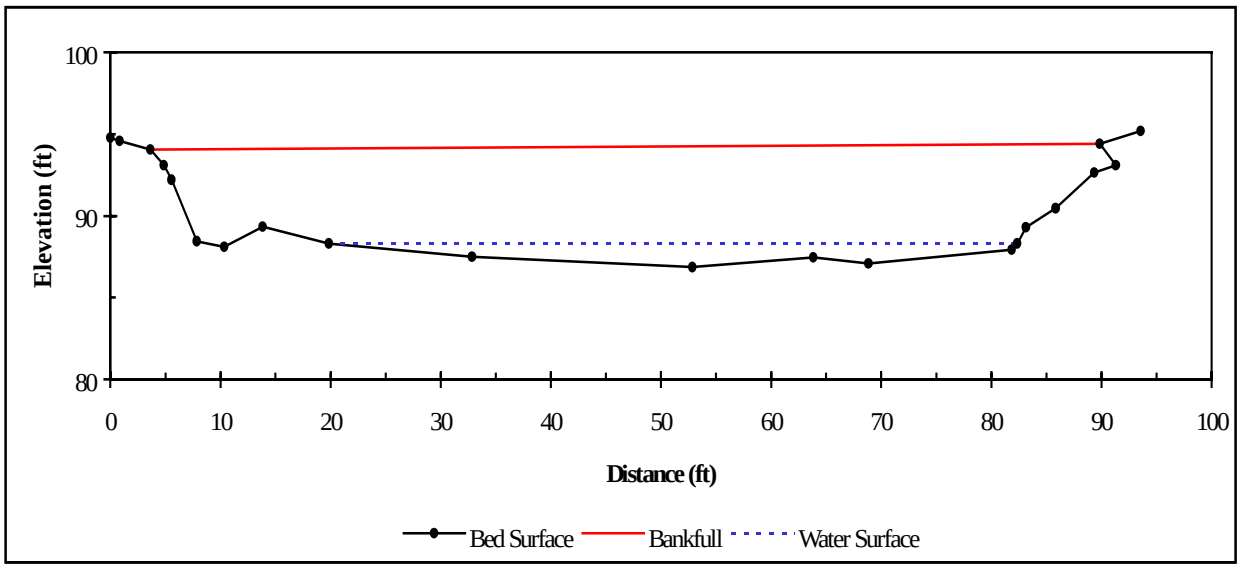
Average Water Surface Slope (ft/ft):	0.0013	Flood-prone Width (ft):	318.00
Manning's "n":	0.033	Entrenchment Ratio:	3.69
Mean Bankfull Velocity (ft/sec):	5.12	Width/Depth Ratio:	14.32
u/u*:	10.67	Channel Sinuosity:	1.45
R/D_{84}:	7.96	Beltwidth:	625
Froude Number:	0.37	Meander Width Ratio:	7.3

BIG PIPE CREEK AT BRUCEVILLE, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	6.23
D_{35}	8.48	39.19
D_{50}	20.17	62.48
D_{84}	167.73	210.51
D_{95}	Bedrock	343.10

STUDY REACH CROSS SECTION



Bankfull Width (ft):	86.20	Mean Bankfull Depth (ft):	6.02
Bankfull Cross-sectional Area (ft^2):	518.65	Maximum Bankfull Depth (ft):	7.27
Hydraulic Radius (ft):	5.49	Wetted Perimeter (ft):	94.39

Big Pipe Creek at Bruceville, Maryland

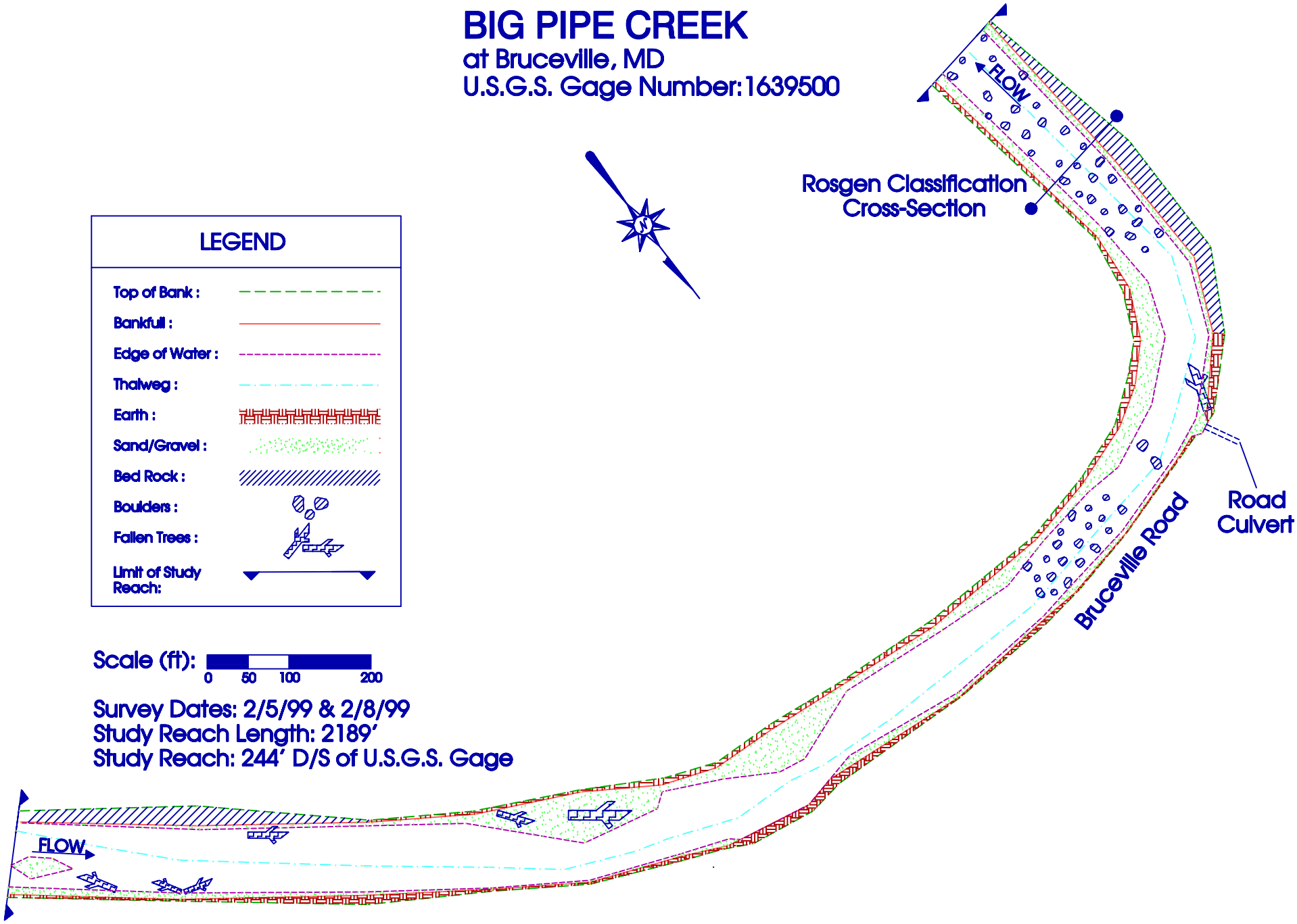
Upstream view of classification cross-section

Right bank of classification cross-section

BIG PIPE CREEK

at Bruceville, MD

U.S.G.S. Gage Number: 1639500



CRANBERRY BRANCH NEAR WESTMINSTER, MD
USGS STATION NUMBER: 1585500

Latitude:	39° 35' 35"	Gage Period of Record:	1949 - Present
Longitude:	76° 58' 05"	Mean Annual Discharge (cfs):	3.31
ADC Map Coordinates:	Carroll / 1994	Rosgen Stream Type:	C4
	Map 20 / A1	Survey Dates:	Oct. 1997
Drainage Area (sq. mi.):	3.40		Sept. 1998
Stream Order / Magnitude:	2 / 6		
Percent Imperviousness:	5.27		

Land Use (%): Residential: 13.53 Agricultural: 62.53 Forest: 20.40 Commercial: 2.22

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 30.20 $Q_{1.5}$: 150.00 $Q_{2.0}$: 234.30
(Log-Pearson Period: 1949 - 1995)

General Study Reach Description: The downstream end of the study reach is 137 feet upstream of the gage, because of ponding at the gage. The reach has pool/riffle features, a regular meander pattern, point-bar depositional features, some lateral scour, and appears vertically stable. There are numerous pieces of large woody debris throughout the reach, with several spanning the entire width. The reach is located in a pasture, and livestock have unrestricted access to the stream. The bank and floodplain vegetation is pasture with scattered trees, mostly willow and box elder. Upstream and downstream of the study reach the channel appears straightened.

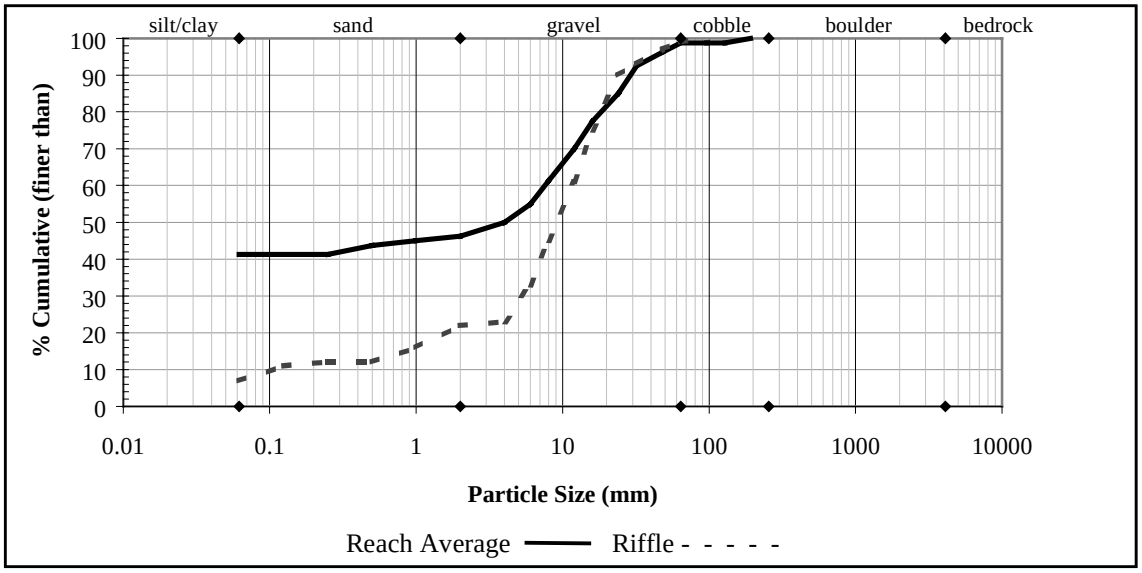
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	162.40	Q_{bkf} / $Q_{2.0}$:	0.69	
Bankfull Return Interval (R.I.):	1.57	$Q_{Top\ of\ Bank}$(cfs):	589.20	R.I.: 5.40
Gage Height (ft):	3.20	$Q_{Active\ Channel}$ (cfs):	37.06	R.I.: 1.02
Q_{bkf} / $Q_{1.5}$:	1.08			

STUDY REACH SURVEY INFORMATION

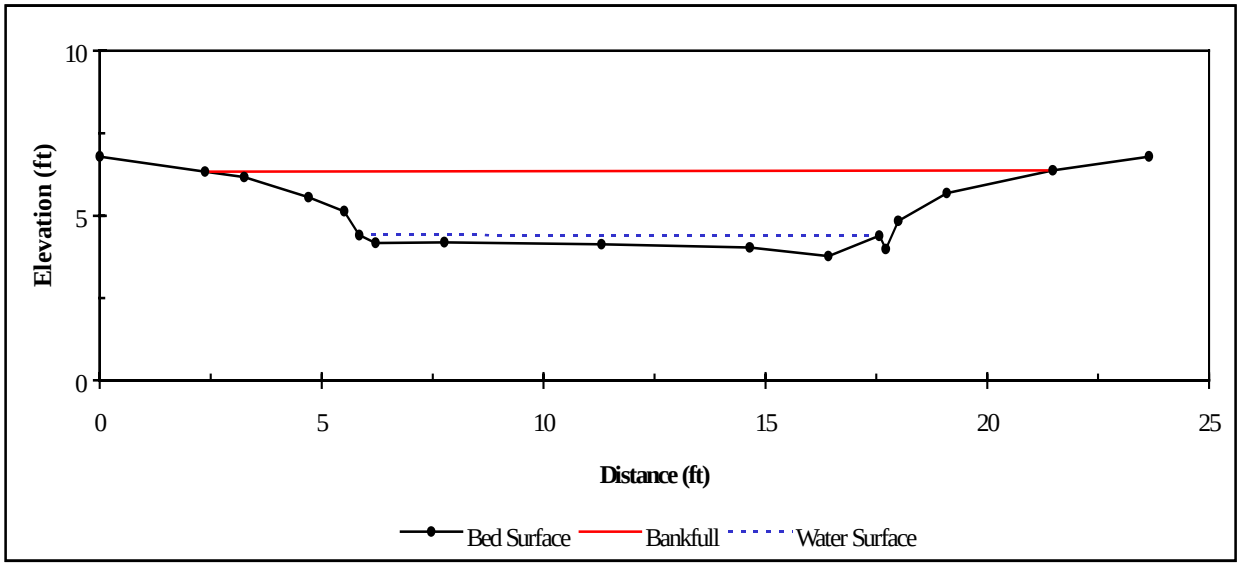
Average Water Surface Slope (ft/ft):	0.0061	Flood-prone Width (ft):	340.00
Manning's "n":	0.029	Entrenchment Ratio:	17.79
Mean Bankfull Velocity (ft/sec):	5.22	Width/Depth Ratio:	11.72
u/u*:	9.67	Channel Sinuosity:	1.60
R/D_{84}:	21.77	Beltwidth:	80
Froude Number:	0.72	Meander Width Ratio:	4.2

CRANBERRY BRANCH NEAR WESTMINSTER, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	1.00
D_{35}	n/a	6.29
D_{50}	4.00	9.08
D_{84}	22.74	20.41
D_{95}	41.93	39.19

STUDY REACH CROSS SECTION



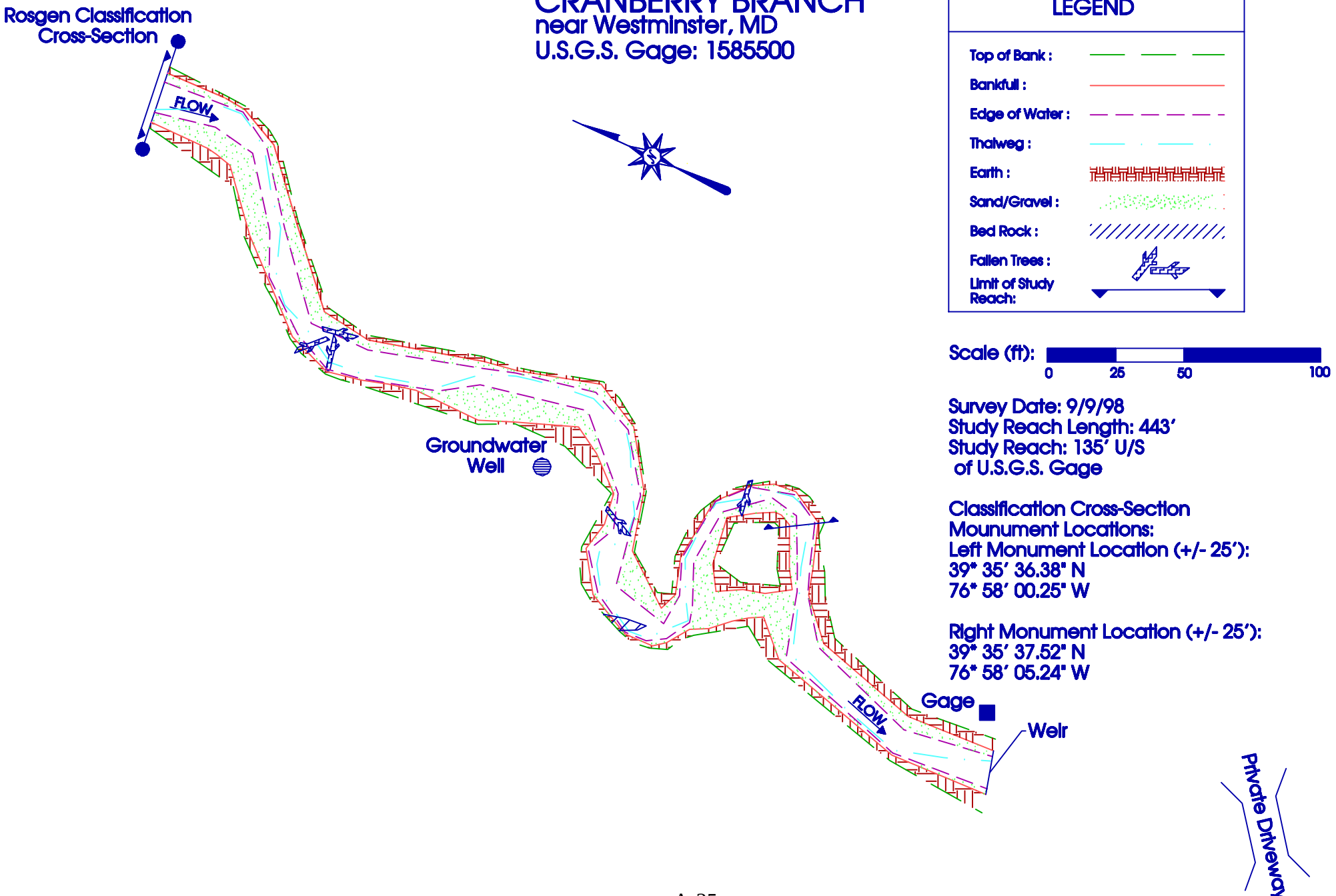
Bankfull Width (ft):	19.11	Mean Bankfull Depth (ft):	1.63
Bankfull Cross-sectional Area (ft^2):	31.13	Maximum Bankfull Depth (ft):	2.56
Hydraulic Radius (ft):	1.46	Wetted Perimeter (ft):	21.35

Cranberry Branch near Westminster, Maryland

Upstream view of classification cross-section

Left bank of classification cross-section

CRANBERRY BRANCH
near Westminster, MD
U.S.G.S. Gage: 1585500



LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Bed Rock :
- Fallen Trees :
- Limit of Study Reach:

Scale (ft): 0 25 50 100

Survey Date: 9/9/98
Study Reach Length: 443'
Study Reach: 135' U/S
of U.S.G.S. Gage

Classification Cross-Section
Mounument Locations:
Left Monument Location (+/- 25'):
39* 35' 36.38" N
76* 58' 00.25" W

Right Monument Location (+/- 25'):
39* 35' 37.52" N
76* 58' 05.24" W

DEER CREEK AT ROCKS, MD
USGS STATION NUMBER: 1580000

Latitude:	39° 37' 49"	Gage Period of Record:	1926 - Present
Longitude:	76° 24' 13"	Mean Annual Discharge (cfs):	126.00
ADC Map Coordinates:	Harford / 1992	Rosgen Stream Type:	B4/1c
	Map 9 / H4	Survey Date:	Sept. 1997
Drainage Area (sq. mi.):	94.40		July 1998
Stream Order / Magnitude:	4 / 99		
Percent Imperviousness:	2.88		

Land Use (%): Residential: 6.94 Agricultural: 60.95 Forest: 30.69 Commercial: 1.14

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 1162.00 $Q_{1.5}$: 2850.00 $Q_{2.0}$: 3613.80
(Log-Pearson Period: 1927 - 1995)

General Study Reach Description: The study reach and the gage reach are the same. The reach has pool/riffle features, a fairly straight, bedrock-controlled meander pattern, poorly developed point- and sidebar depositional features, some lateral scour, and appears vertically stable with bedrock outcrops in the bed. There are several pieces of large woody debris, with one spanning the channel, and numerous boulders throughout the reach. At the upstream end of the reach, the channel is confined by a pair of old railroad bridge abutments. The bank vegetation is a mix of grass and moderately dense mature forest (hemlock, white pine, oak), with a moderately dense understory of mountain laurel.

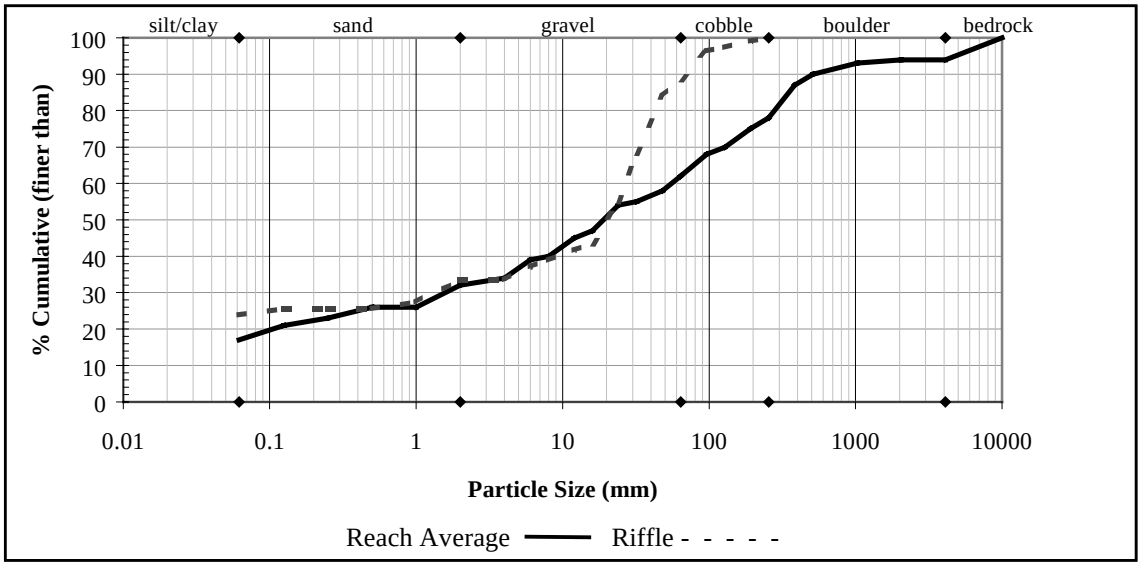
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	2614.00	Q_{bkf} / $Q_{2.0}$:	0.72	
Bankfull Return Interval (R.I.):	1.37	$Q_{Top\ of\ Bank}$(cfs):	3500.00	R.I.: 1.90
Gage Height (ft):	6.99	$Q_{Active\ Channel}$ (cfs):	605.00	R.I.:
Q_{bkf} / $Q_{1.5}$:	0.92			<1.005

STUDY REACH SURVEY INFORMATION

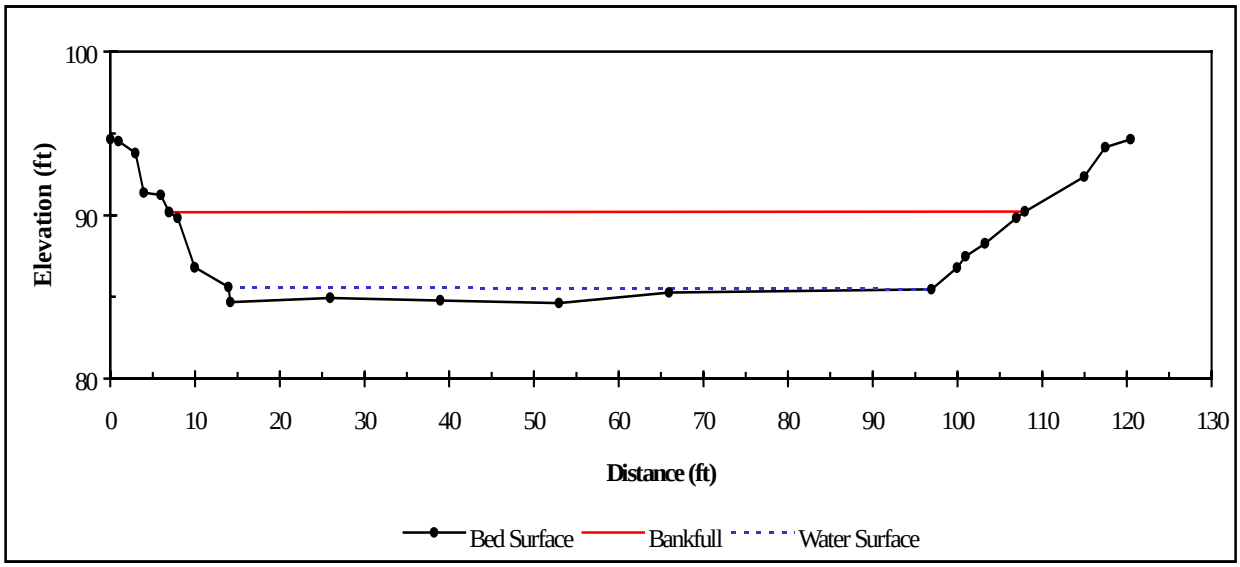
Average Water Surface Slope (ft/ft):	0.0021	Flood-prone Width (ft):	163.00
Manning's "n":	0.033	Entrenchment Ratio:	1.61
Mean Bankfull Velocity (ft/sec):	5.52	Width/Depth Ratio:	21.54
u/u*:	10.22	Channel Sinuosity:	1.22
R/D_{84}:	27.94	Beltwidth:	500
Froude Number:	0.45	Meander Width Ratio:	5.0

DEER CREEK AT ROCKS, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	n/a
D_{35}	4.34	4.68
D_{50}	19.04	20.22
D_{84}	335.45	47.91
D_{95}	Bedrock	89.12

STUDY REACH CROSS SECTION

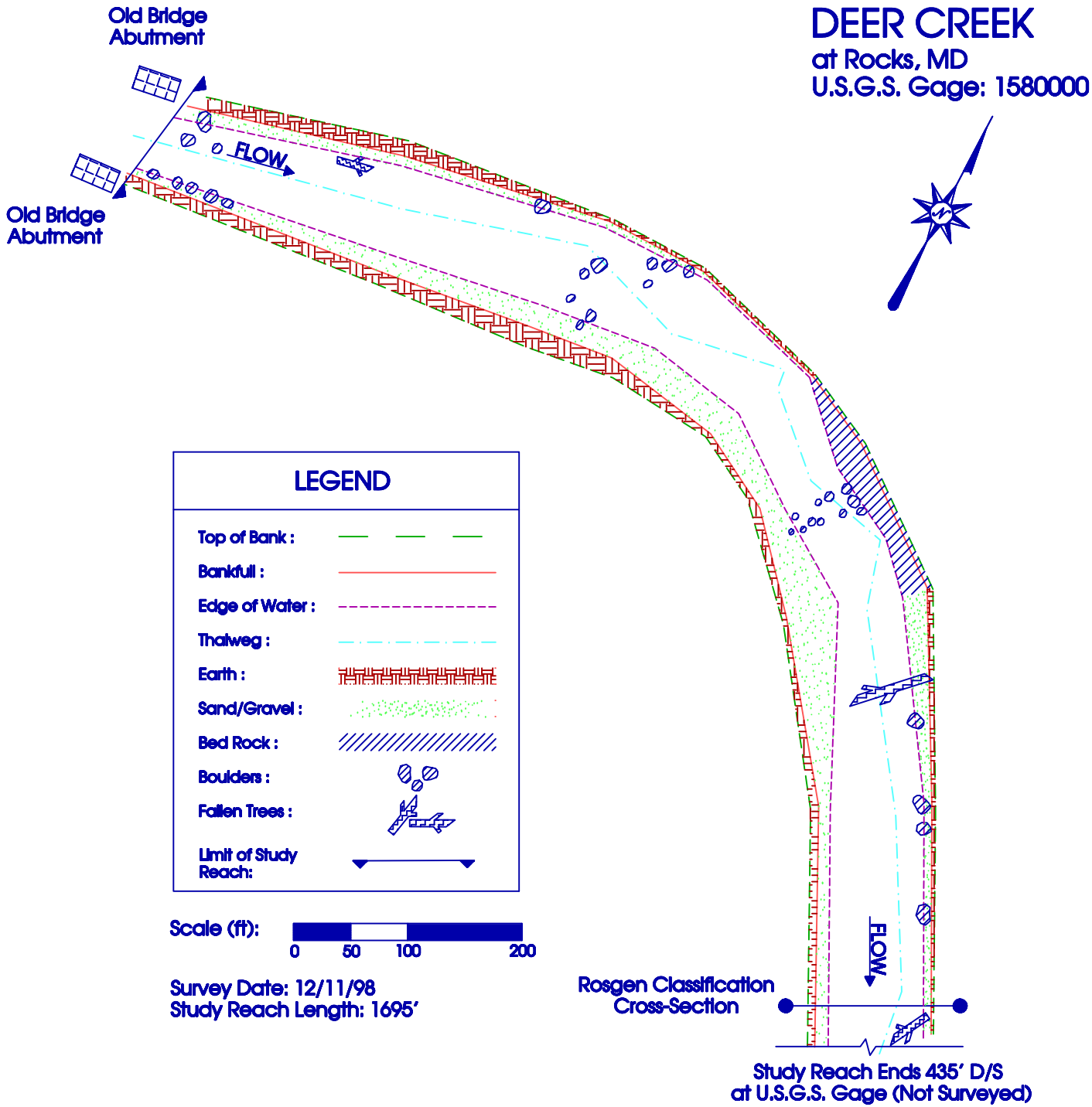


Bankfull Width (ft):	101.00	Mean Bankfull Depth (ft):	4.69
Bankfull Cross-sectional Area (ft^2):	473.67	Maximum Bankfull Depth (ft):	5.58
Hydraulic Radius (ft):	4.39	Wetted Perimeter (ft):	107.86

Deer Creek at Rocks, Maryland

Upstream view of classification cross-section

Right bank of classification cross-section


Old Bridge Abutment
DEER CREEK
at Rocks, MD
U.S.G.S. Gage: 1580000
FLOW
Old Bridge Abutment
LEGEND
Top of Bank :
Bankfull :
Edge of Water :
Thalweg :
Earth :
Sand/Gravel :
Bed Rock :
Boulders :
Fallen Trees :
Limit of Study Reach:
Scale (ft):
0
50
100
200
Survey Date: 12/11/98
Study Reach Length: 1695'
FLOW
Rosgen Classification Cross-Section
Study Reach Ends 435' D/S at U.S.G.S. Gage (Not Surveyed)

HAWLINGS RIVER NEAR SANDY SPRING, MD
USGS STATION NUMBER: 1591700

Latitude:	39° 10' 29"	Gage Period of Record:	1978 - Present
Longitude:	77° 01' 22"	Mean Annual Discharge (cfs):	30.70
ADC Map Coordinates:	Montgomery / 1998 Map 22 / B3	Rosgen Stream Type:	C5
		Survey Date:	Oct. 1997 Jan. 1999
Drainage Area (sq. mi.):	27.00		
Stream Order / Magnitude:	4 / 50		
Percent Imperviousness:	6.86		

Land Use (%): Residential: 17.83 Agricultural: 48.03 Forest: 28.32 Commercial: 1.84

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 185.40 $Q_{1.5}$: 940.00 $Q_{2.0}$: 1352.00
(Log Pearson Period: 1979 - 1998)

General Study Reach Description: The upstream end of the study reach is 638 feet downstream of the gage because the intervening riffle is unusually long and steep. The reach has pool/riffle features, a regular meander pattern with point-bar depositional features, some lateral scour, and appears vertically stable. There are numerous pieces of large woody debris, with several spanning the channel, resulting in one mid-channel bar. There is one bedrock outcrop. The bank vegetation is moderately dense forest, consisting of red maple and sycamore, with a moderately dense under-story of multiflora rose. The floodplain vegetation is a mix of forest and old-field, the latter predominantly multiflora rose.

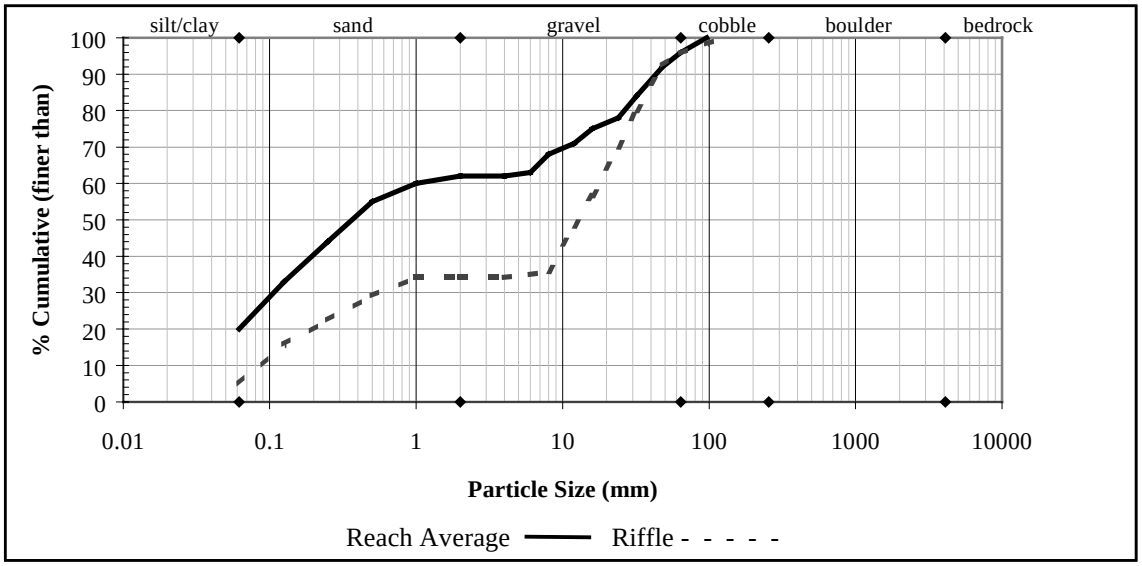
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	1030.00	Q_{bkf} / $Q_{2.0}$:	0.76	
Bankfull Return Interval (R.I.):	1.60	$Q_{Top\ of\ Bank}$(cfs):	1168.00	R.I.: 1.75
Gage Height (ft):	5.38	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	1.10			

STUDY REACH SURVEY INFORMATION

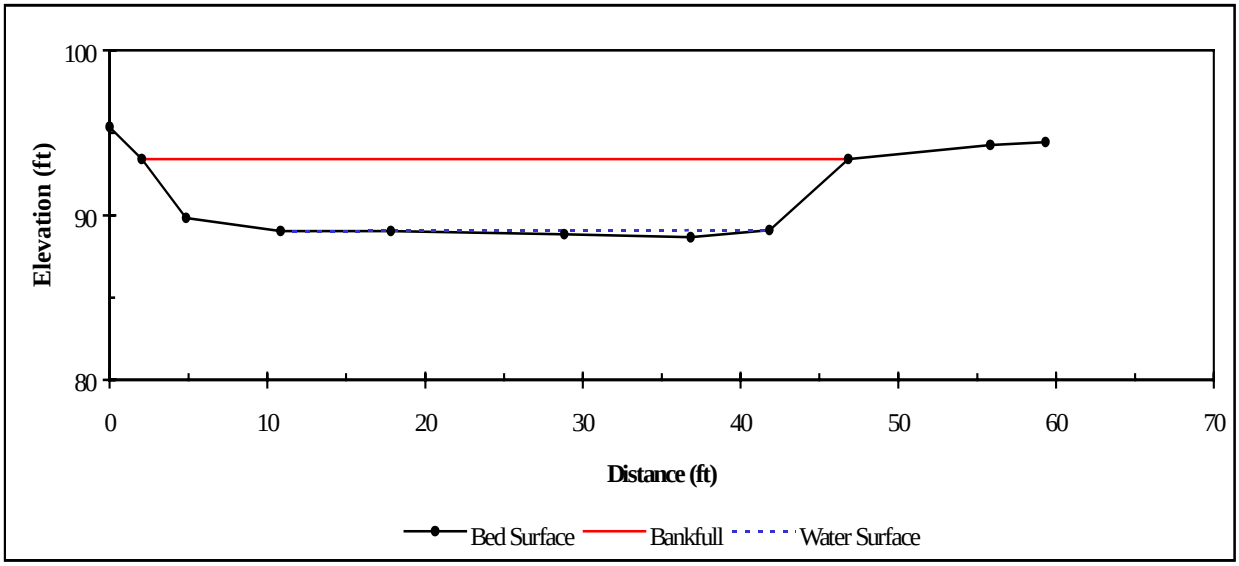
Average Water Surface Slope (ft/ft):	0.0022	Flood-prone Width (ft):	635.00
Manning's "n":	0.029	Entrenchment Ratio:	14.17
Mean Bankfull Velocity (ft/sec):	5.74	Width/Depth Ratio:	11.20
u/u*:	11.25	Channel Sinuosity:	1.19
R/D_{84}:	31.14	Beltwidth:	102
Froude Number:	0.51	Meander Width Ratio:	2.3

HAWLINGS RIVER NEAR SANDY SPRING, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	0.13
D_{35}	0.14	6.00
D_{50}	0.36	12.71
D_{84}	32.00	36.43
D_{95}	59.56	59.56

STUDY REACH CROSS SECTION



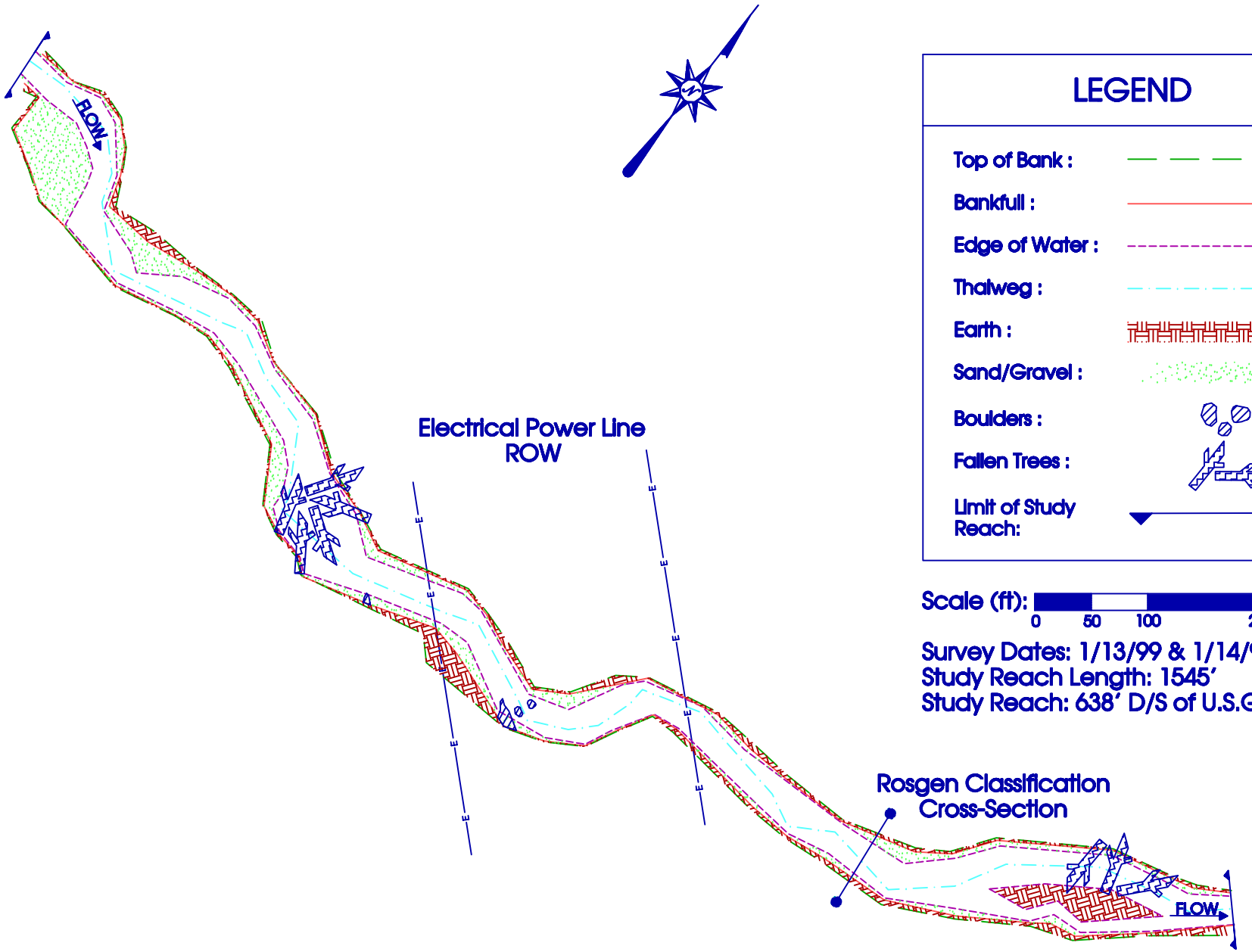
Bankfull Width (ft):	44.80	Mean Bankfull Depth (ft):	4.00
Bankfull Cross-sectional Area (ft^2):	179.31	Maximum Bankfull Depth (ft):	4.74
Hydraulic Radius (ft):	3.72	Wetted Perimeter (ft):	48.21

Hawlings River near Sandy Springs, Maryland

Downstream view of classification cross-section

Right bank of classification cross-section

HAWLINGS RIVER
near Sandy Springs, MD
U.S.G.S. Gage: 1591700



LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Boulders :
- Fallen Trees :
- Limit of Study Reach:

Scale (ft): 0 50 100 200

Survey Dates: 1/13/99 & 1/14/99
Study Reach Length: 1545'
Study Reach: 638' D/S of U.S.G.S. Gage

JONES FALLS AT SORRENTO, MD
USGS STATION NUMBER: 1589440

Latitude:	39° 23' 30"	Gage Period of Record:	1966 – 1988
Longitude:	76° 39' 42"		1996 - Present
ADC Map Coordinates:	Baltimore / 1993	Mean Annual Discharge (cfs):	32.50
	Map 26 / E7-8	Rosgen Stream Type:	C4
Drainage Area (sq. mi.):	25.20	Survey Date:	Oct. 1998
Stream Order / Magnitude:	3 / 25		Jan. 1999
Percent Imperviousness:	21.43		

Land Use (%): Residential: 46.84 Agricultural: 19.54 Forest: 24.82 Commercial: 7.23

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 250.60 $Q_{1.5}$: 840.00 $Q_{2.0}$: 1190.00
(Log-Pearson Period: 1975 - 1998)

General Study Reach Description: The study reach and gage reach are the same. The reach has pool/riffle features, a straight meander pattern with point- and side-bar depositional features, and some lateral scour. A sanitary sewer pipe has been exposed downstream of the gage. The channel appears altered and may have been straightened in the past due to construction of Falls Road. The bank and floodplain vegetation is moderately dense mature forest with a moderately dense understory of sapling trees and shrubs.

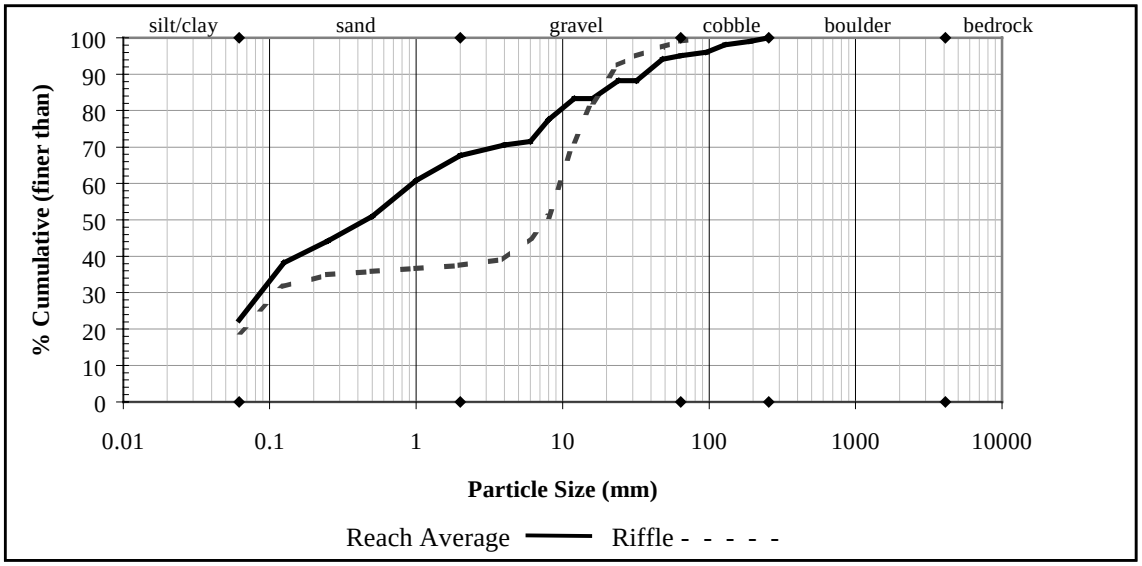
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	914.70	Q_{bkf} / $Q_{2.0}$:	0.77	
Bankfull Return Interval (R.I.):	1.57	$Q_{Top\ of\ Bank}$(cfs):	1137.00	R.I.: 2.00
Gage Height (ft):	7.32	$Q_{Active\ Channel}$ (cfs):	581.60	R.I.: 1.20
Q_{bkf} / $Q_{1.5}$:	1.09			

STUDY REACH SURVEY INFORMATION

Average Water Surface Slope (ft/ft):	0.0016	Flood-prone Width (ft):	196.00
Manning's "n":	0.027	Entrenchment Ratio:	3.63
Mean Bankfull Velocity (ft/sec):	4.93	Width/Depth Ratio:	15.74
u/u*:	12.02	Channel Sinuosity:	1.13
R/D_{84}:	59.46	Beltwidth:	
Froude Number:	0.47	Meander Width Ratio:	1.9

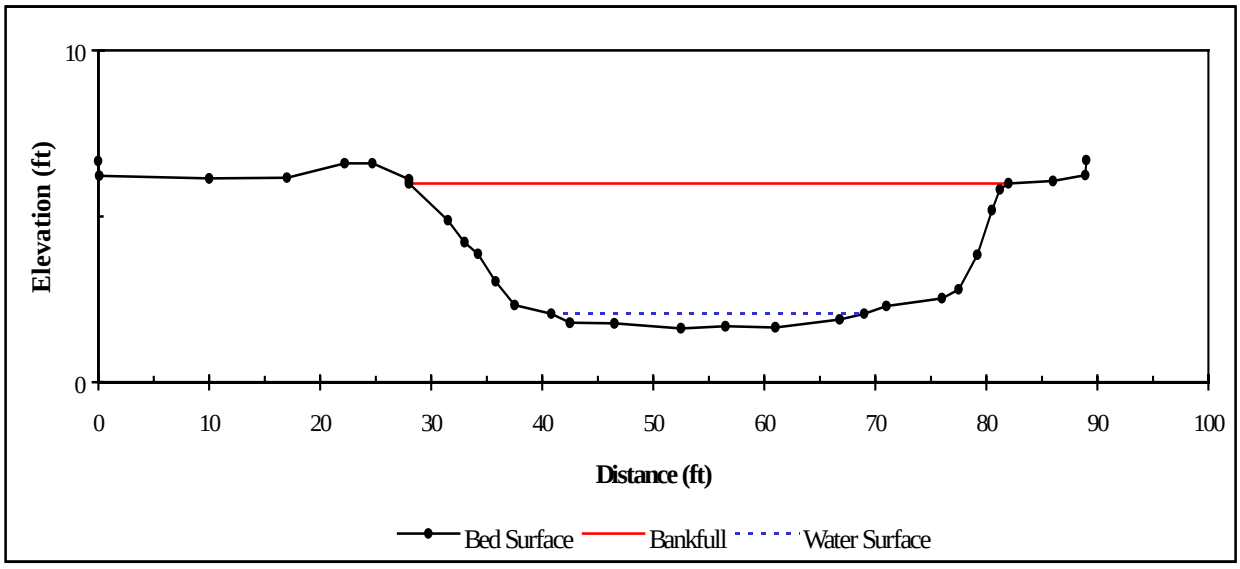
JONES FALLS AT SORRENTO, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	n/a
D_{35}	0.11	0.30
D_{50}	0.45	7.70
D_{84}	16.91	17.00
D_{95}	62.19	32.00

The reach pebble count distribution is bi-modal (sand and gravel). The largest number of oberservations is in the gravel size class. The riffle pebble count D_{50} is gravel.

STUDY REACH CROSS SECTION



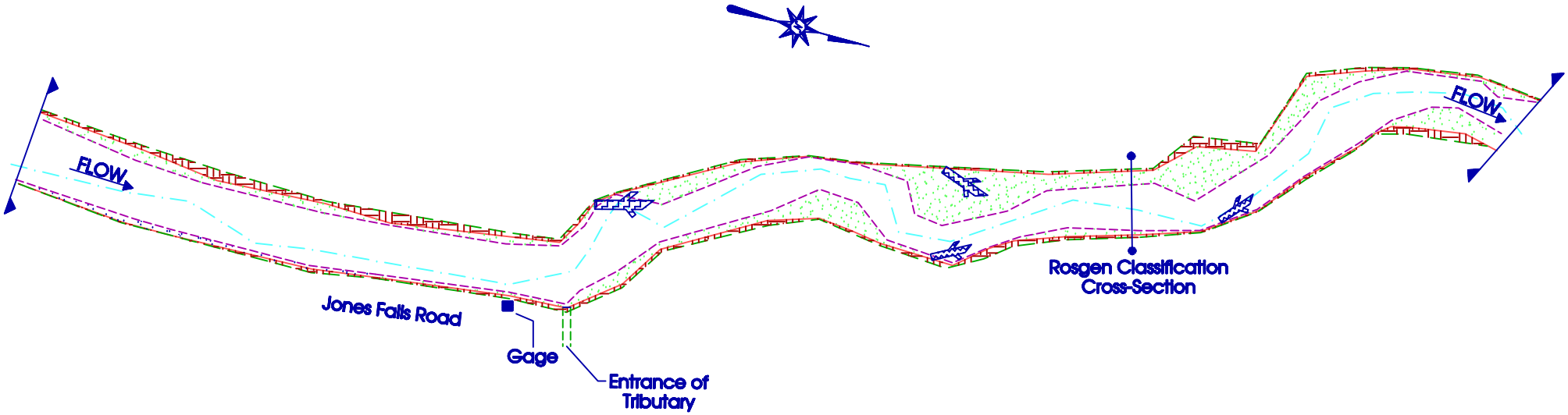
Bankfull Width (ft):	54.00	Mean Bankfull Depth (ft):	3.43
Bankfull Cross-sectional Area (ft^2):	185.45	Maximum Bankfull Depth (ft):	4.36
Hydraulic Radius (ft):	3.32	Wetted Perimeter (ft):	55.92

Jones Falls at Sorrento, Maryland

Downstream view of classification cross-section

Left bank of classification cross-section

JONES FALLS
at Sorrento, MD
U.S.G.S. Gage:1589440



LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Fallen Trees :
- Limit of Study Reach:

Scale (ft): 0 50 100 200

Survey Dates: 1/5/99 & 1/6/99
Study Reach Length 1308'

Classification Cross-Section Monument Locations:
Left Monument Location (+/- 15):
39° 23' 26.07" N
79° 39' 35.37" W
Elevation: 284'

Right Monument Location (+/- 15):
39° 23' 25.32" N
76° 39' 36.54" W
Elevation: 246'

LITTLE FALLS AT BLUE MOUNT, MD
USGS STATION NUMBER: 1582000

Latitude:	39° 36' 16"	Gage Period of Record:	1944 - Present
Longitude:	76° 37' 16"	Mean Annual Discharge (cfs):	68.60
ADC Map Coordinates:	Baltimore / 1993	Rosgen Stream Type:	C4
	Map 8 / A8	Survey Date:	Oct. 1997
Drainage Area (sq. mi.):	52.90		Dec. 1998
Stream Order / Magnitude:	4 / 68		
Percent Imperviousness:	2.77		

Land Use (%): Residential: 8.24 Agricultural: 53.14 Forest: 37.00 Commercial: 0.76

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 524.4 (sys) $Q_{1.5}$: 1750.00 $Q_{2.0}$: 2230.00
(Log-Pearson Period: 1945 - 2000)

General Study Reach Description: The downstream end of the study reach is 450 feet upstream of the gage because the intervening reach exhibits aggradation and lateral adjustment. The study reach has pool/riffle features, a regular, bedrock-controlled meander pattern with point and side bar depositional features, and some lateral scour. Several pieces of large woody debris are in the reach, but none span the channel, although one is causing some mid-channel aggradation through a riffle. The bank and floodplain vegetation is moderately dense forest, consisting of oak, red maple and sycamore. The forest is mature on the right bank, but relatively young on the left. The understory on both sides is a low-density mix of sapling trees and shrubs. The channel is bordered on the left by a maintained trail on a railroad bed that crosses the channel at the upstream end and at the gage.

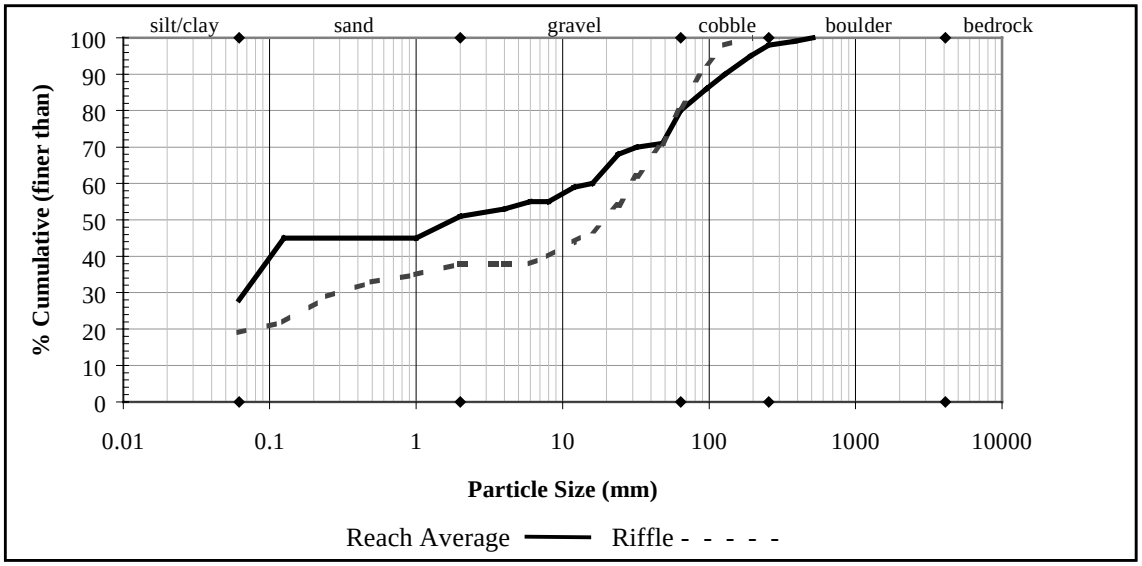
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	1674.00	Q_{bkf} / $Q_{2.0}$:	0.75	
Bankfull Return Interval (R.I.):	1.45	$Q_{Top\ of\ Bank}$(cfs):	3161.00	R.I.: 4.00
Gage Height (ft):	5.47	$Q_{Active\ Channel}$ (cfs):	851.10	R.I.:1.03
Q_{bkf} / $Q_{1.5}$:	0.96			(SYS)

STUDY REACH SURVEY INFORMATION

Average Water Surface Slope (ft/ft):	0.0019	Flood-prone Width (ft):	313.50
Manning's "n":	0.036	Entrenchment Ratio:	4.61
Mean Bankfull Velocity (ft/sec):	4.99	Width/Depth Ratio:	13.79
u/u*:	9.42	Channel Sinuosity:	1.09
R/D_{84}:	20.12	Beltwidth:	204
Froude Number:	0.40	Meander Width Ratio:	3.0

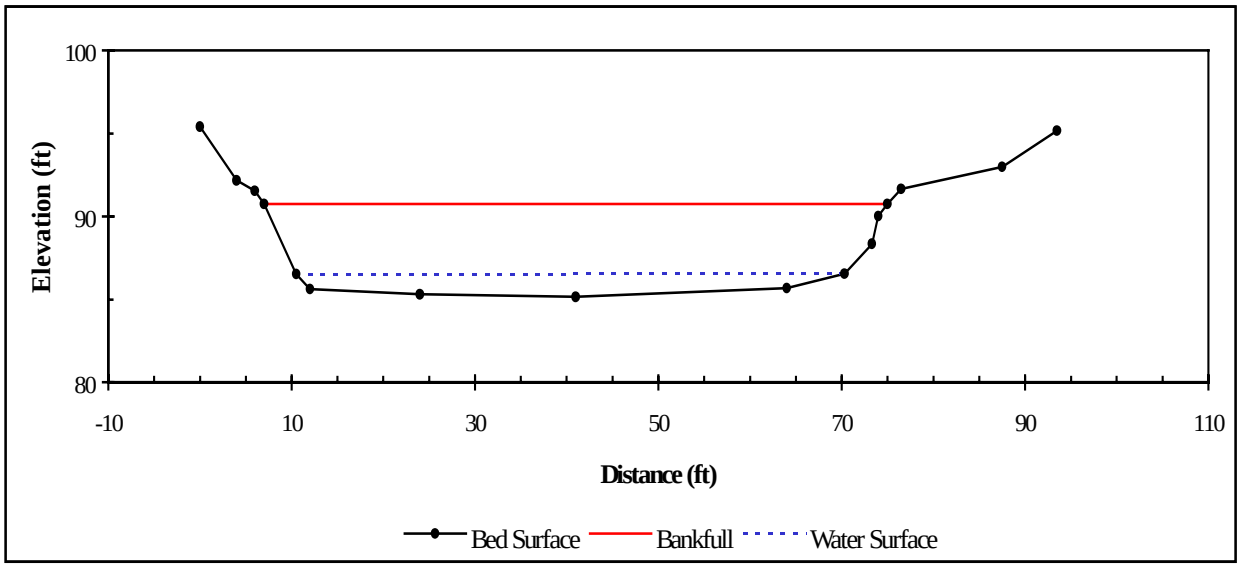
LITTLE FALLS AT BLUE MOUNT, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	n/a
D_{35}	0.08	1.09
D_{50}	1.74	18.73
D_{84}	82.96	70.40
D_{95}	192.00	108.82

The reach pebble count distribution is bi-modal (silt/clay and gravel). The largest number of oberservations is in the gravel size class. The riffle pebble count D_{50} is gravel.

STUDY REACH CROSS SECTION



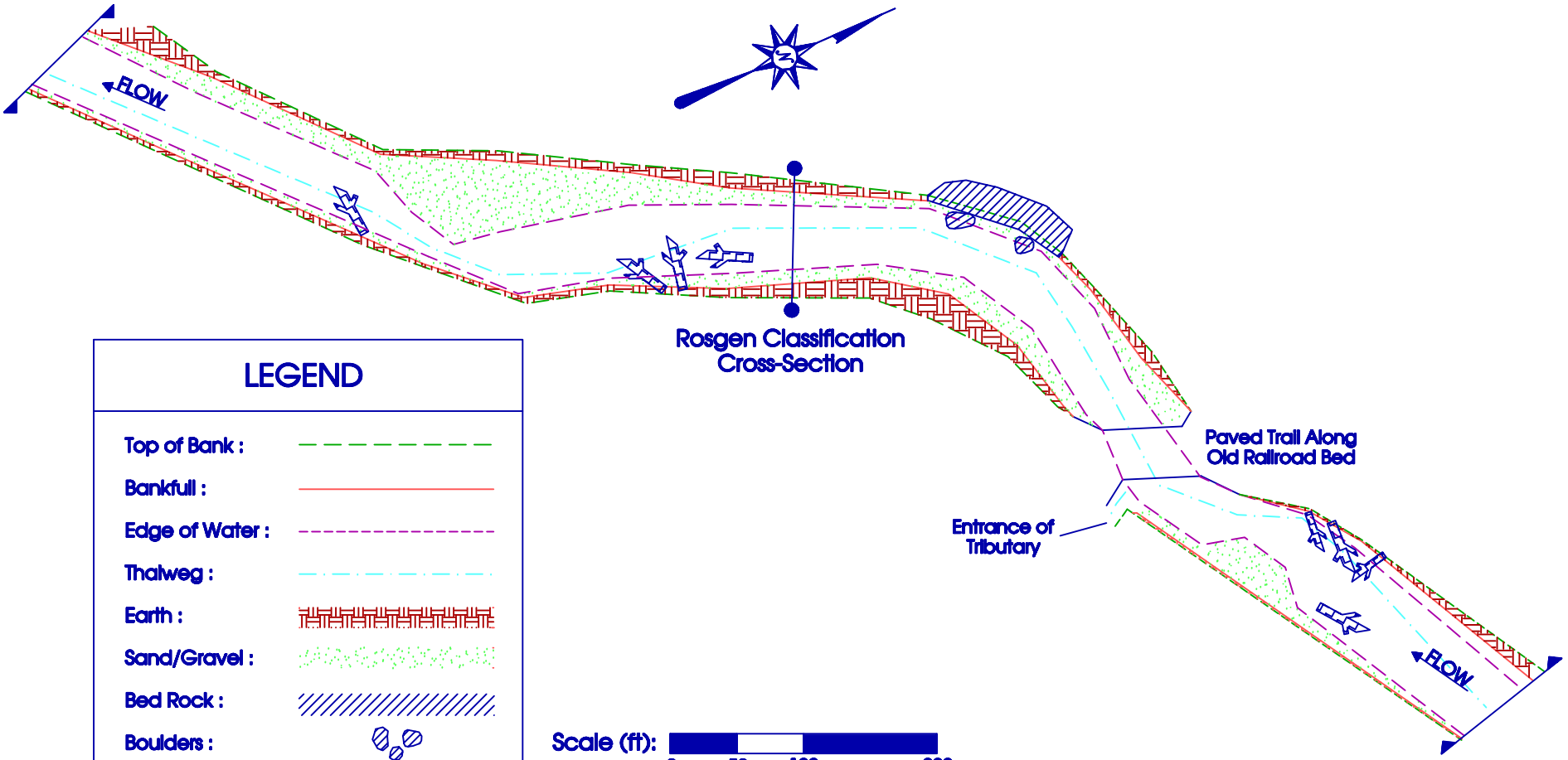
Bankfull Width (ft):	68.00	Mean Bankfull Depth (ft):	4.93
Bankfull Cross-sectional Area (ft^2):	335.26	Maximum Bankfull Depth (ft):	5.60
Hydraulic Radius (ft):	4.65	Wetted Perimeter (ft):	72.16

Little Falls at Blue Mount, Maryland

Downstream view of classification cross-section

Right bank of classification cross-section

LITTLE FALLS
at Blue Mount, MD
U.S.G.S. Gage:1582000



LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Bed Rock :
- Boulders :
- Fallen Trees :
- Limit of Study Reach:

Scale (ft): 0 50 100 200

Survey Date: 12/21/98
Study Reach Length: 1278'
Study Reach: 450' U/S of U.S.G.S. Gage

LITTLE PATUXENT RIVER AT GUILFORD
USGS STATION NUMBER: 1593500

Latitude:	39° 10' 04"	Gage Period of Record:	1932 - Present
Longitude:	76° 51' 07"	Mean Annual Discharge (cfs):	43.90
ADC Map Coordinates:	Howard / 1992	Rosgen Stream Type:	E5
	Map 19 / H-J2	Survey Date:	Oct. 1997
Drainage Area (sq. mi.):	38.00		Dec. 1998
Stream Order / Magnitude:	4 / 99		Oct. 2000
Percent Imperviousness:	18.48		

Land Use (%): Residential: 33.40 Agricultural: 25.03 Forest: 30.95 Commercial: 7.33

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 444.50 $Q_{1.5}$: 1050.00 $Q_{2.0}$: 1362.60
(Log-Pearson Period: 1933 - 1995)

General Study Reach Description: The study reach and the gage reach are the same. The reach has pool/riffle features, a regular meander pattern with few point bar depositional features, some lateral scour, and appears vertically stable. There are numerous pieces of large woody debris in the middle of the reach, with several pieces extending well into the channel. The lower end of the reach is stabilized on the right bank by boulder revetment associated with Guilford Road. The bank and floodplain vegetation is moderately dense forest, consisting of green ash, red maple, oak and sycamore, with a moderately dense understory of sapling trees and shrubs.

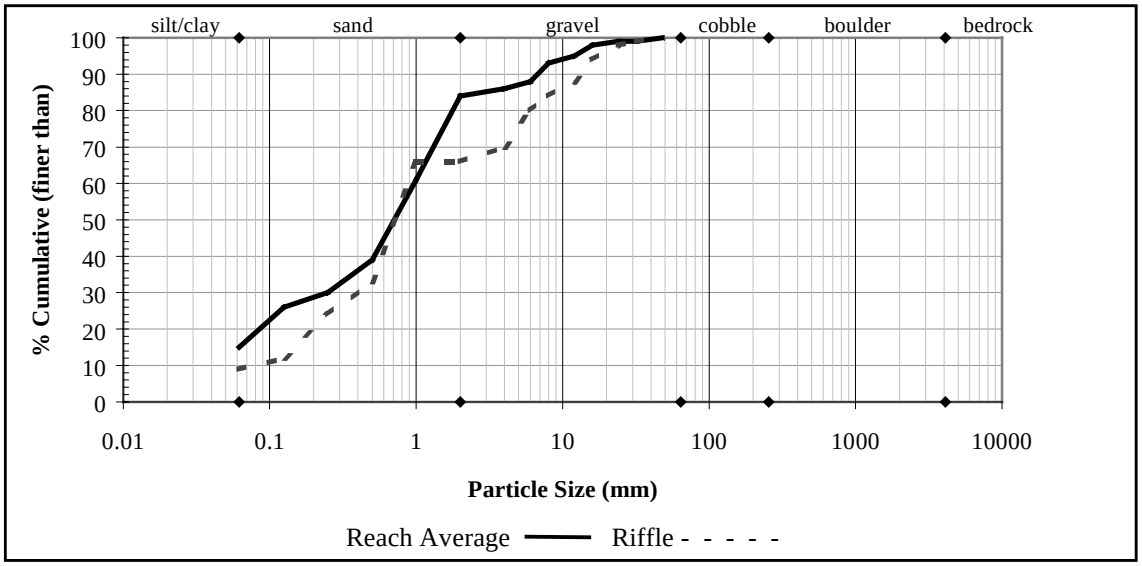
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	1024.00	Q_{bkf} / $Q_{2.0}$:	0.75	
Bankfull Return Interval (R.I.):	1.48	$Q_{Top\ of\ Bank}$(cfs):	1435.00	R.I.: 2.20
Gage Height (ft):	7.10	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	0.98			

STUDY REACH SURVEY INFORMATION

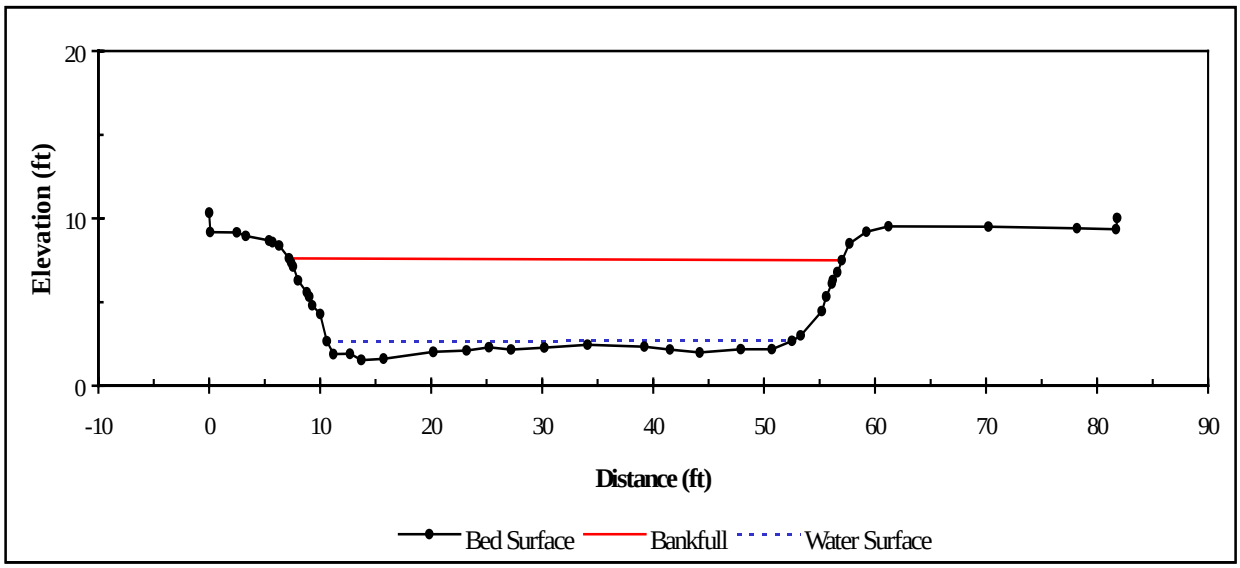
Average Bankfull Slope (ft/ft):	0.0005	Flood-prone Width (ft):	478.00
Manning's "n":	0.022	Entrenchment Ratio:	9.60
Mean Bankfull Velocity (ft/sec):	4.08	Width/Depth Ratio:	9.88
u/u*:	15.11	Channel Sinuosity:	1.37
R/D_{84}:	172.53	Beltwidth:	266
Froude Number:	0.32	Meander Width Ratio:	5.3

LITTLE PATUXENT RIVER AT GUILFORD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	0.07	0.16
D_{35}	0.37	0.52
D_{50}	0.71	0.71
D_{84}	2.00	8.00
D_{95}	12.00	17.71

STUDY REACH CROSS SECTION

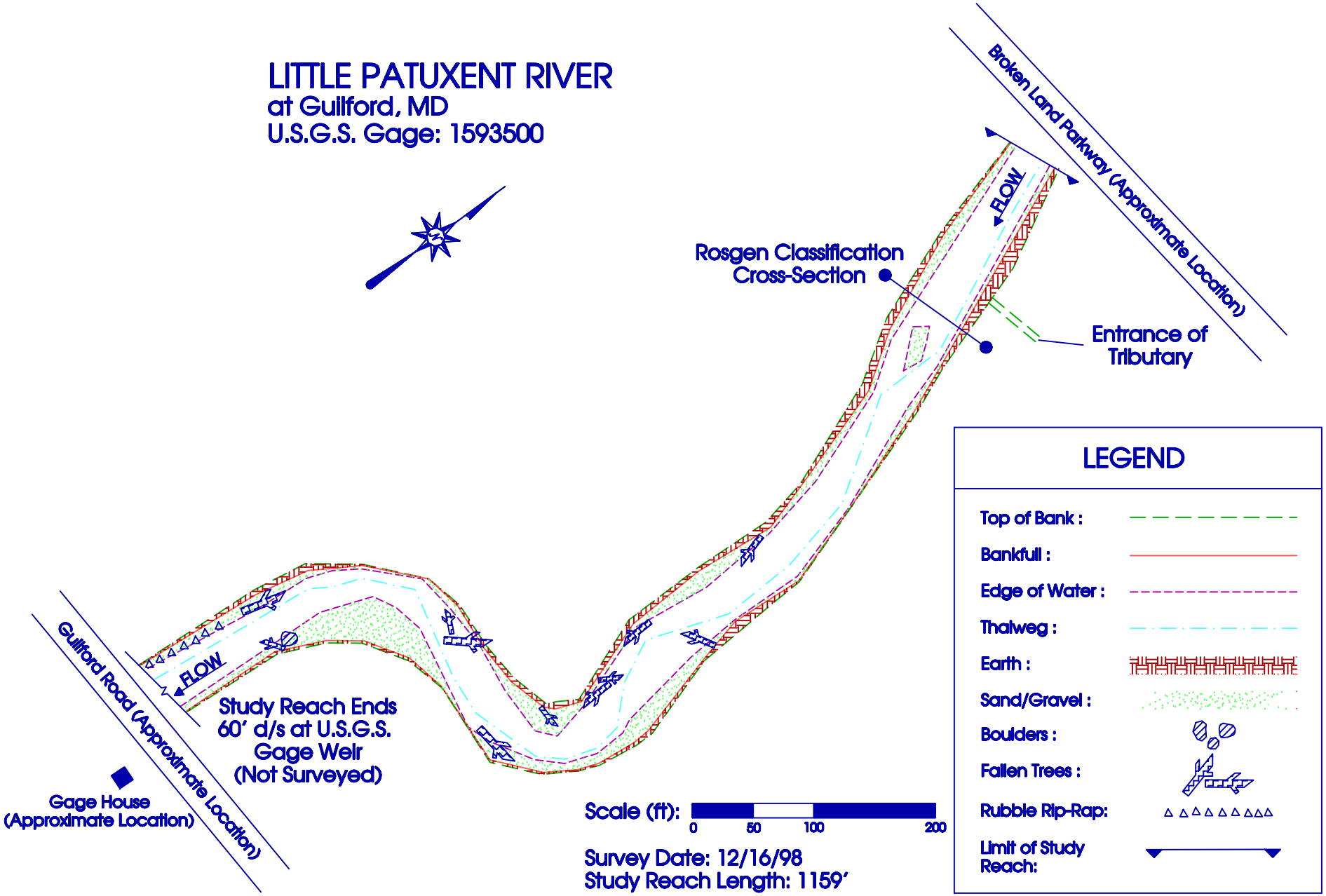


Bankfull Width (ft):	49.80	Mean Bankfull Depth (ft):	5.04
Bankfull Cross-sectional Area (ft^2):	251.05	Maximum Bankfull Depth (ft):	6.08
Hydraulic Radius (ft):	4.53	Wetted Perimeter (ft):	55.44

Little Patuxent River at Guilford, Maryland

Upstream view of classification cross-section

Right bank of classification cross-section


LITTLE PATUXENT RIVER
at Guilford, MD
U.S.G.S. Gage: 1593500
Broken Land Parkway (Approximate Location)
FLOW
Rosgen Classification
Cross-Section
Entrance of
Tributary
FLOW
Study Reach Ends
60' d/s at U.S.G.S.
Gage Weir
(Not Surveyed)
Guilford Road (Approximate Location)
Gage House
(Approximate Location)
Scale (ft):
0
50
100
200
Survey Date: 12/16/98
Study Reach Length: 1159'
LEGEND
Top of Bank :
Bankfull :
Edge of Water :
Thalweg :
Earth :
Sand/Gravel :
Boulders :
Fallen Trees :
Rubble Rip-Rap:
Limit of Study
Reach:

LONG GREEN CREEK AT GLEN ARM, MD
USGS STATION NUMBER: 1584050

Latitude:	39° 27' 17"	Gage Period of Record:	1975 - Present
Longitude:	76° 28' 45"	Mean Annual Discharge (cfs):	11.50
ADC Map Coordinates:	Baltimore / 1993	Rosgen Stream Type:	C2/1
	Map 21 / B-C10	Survey Date:	Oct. 1997
Drainage Area (sq. mi.):	9.40		Feb. 1999
Stream Order / Magnitude:	3 / 18		Aug. 2000
Percent Imperviousness:	12.36		

Land Use (%): Residential: 18.82 Agricultural: 52.57 Forest: 19.31 Commercial: 9.02

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 85.20 $Q_{1.5}$: 460.00 $Q_{2.0}$: 690.20
(Log-Pearson Period: 1976 - 1994)

General Study Reach Description: The upstream end of the study reach is 507 feet downstream of the gage. The reach has cascade features, a relatively straight boulder-controlled meander pattern with no depositional features, and appears vertically stable. There is no large woody debris, but large boulders are abundant and distributed throughout the reach. Upstream of the private road crossing, the right bank and floodplain vegetation is grass lawn, while the left bank has young trees and shrubs with little or no floodplain due to encroachment by the road. Downstream of the bridge, the bank and floodplain vegetation on both sides is moderately dense forest, consisting of green ash, holly, tulip, poplar, and walnut with a moderately dense understory consisting mostly of multiflora rose and privet.

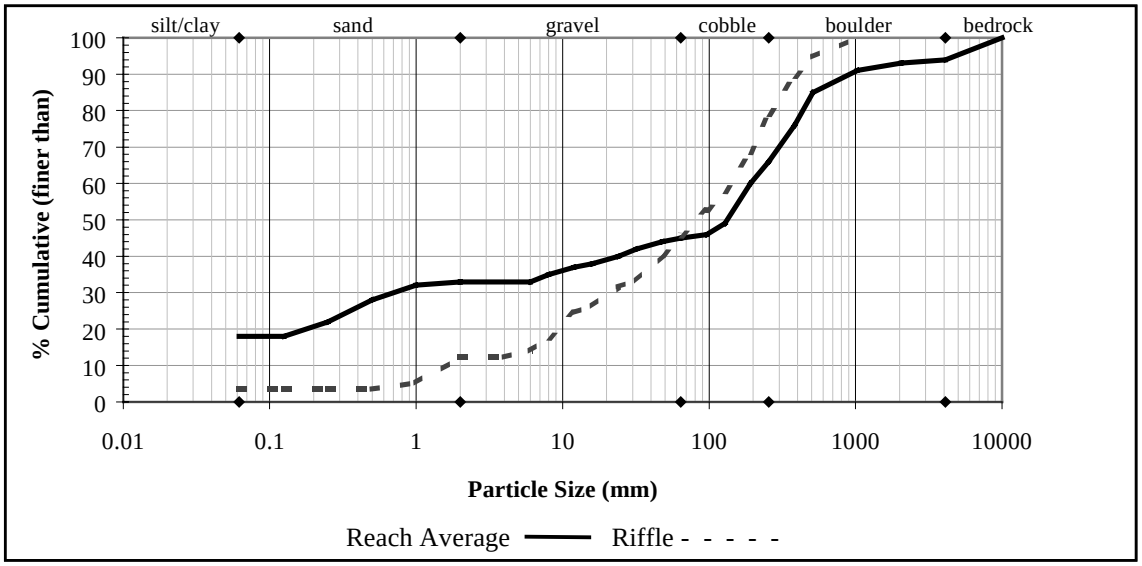
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	365.10	Q_{bkf} / $Q_{2.0}$:	0.53	
Bankfull Return Interval (R.I.):	1.32	$Q_{Top\ of\ Bank}$(cfs):	> 3250	R.I.: >15
Gage Height (ft):	3.70	$Q_{Active\ Channel}$ (cfs):	110.30	R.I.: 1.02
Q_{bkf} / $Q_{1.5}$:	0.79			

STUDY REACH SURVEY INFORMATION

Average Water Surface Slope (ft/ft):	0.0165	Flood-prone Width (ft):	184.00
Manning's "n":	0.064	Entrenchment Ratio:	4.22
Mean Bankfull Velocity (ft/sec):	4.40	Width/Depth Ratio:	22.95
u/u*:	4.53	Channel Sinuosity:	1.04
R/D_{84}:	1.75	Beltwidth:	46
Froude Number:	0.56	Meander Width Ratio:	1.1

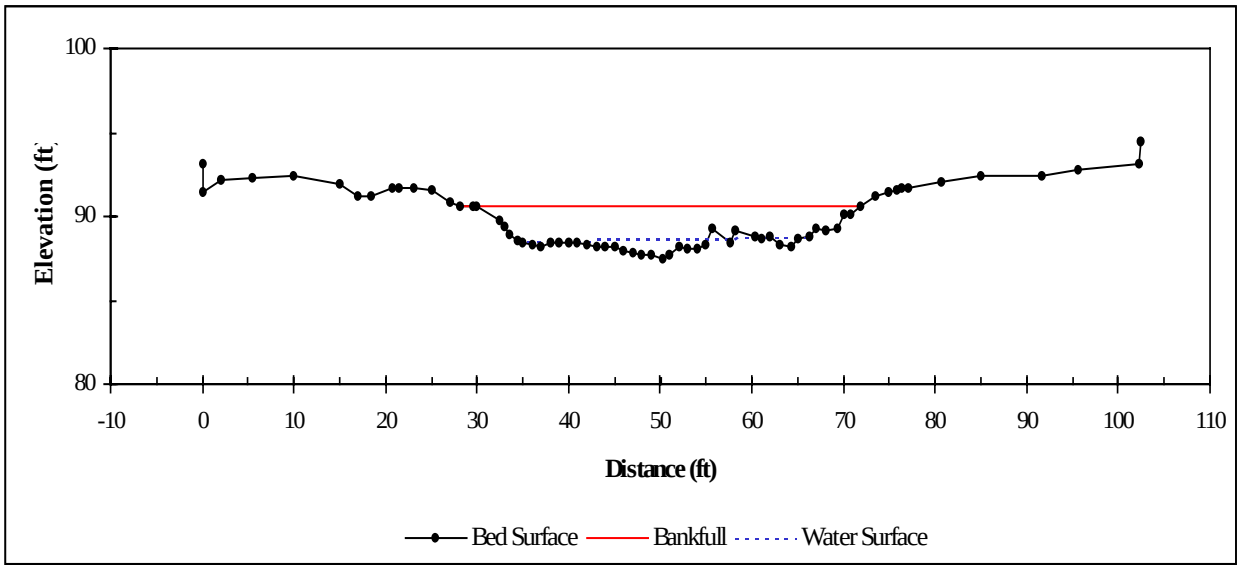
LONG GREEN CREEK AT GLEN ARM, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	7.05
D_{35}	8.00	35.23
D_{50}	132.81	82.46
D_{84}	495.89	311.00
D_{95}	Bedrock	530.06

The reach pebble count distribution is bi-modal (silt and boulder). The largest number of observations is in the boulder size class. The riffle pebble count D_{50} is cobble.

STUDY REACH CROSS SECTION



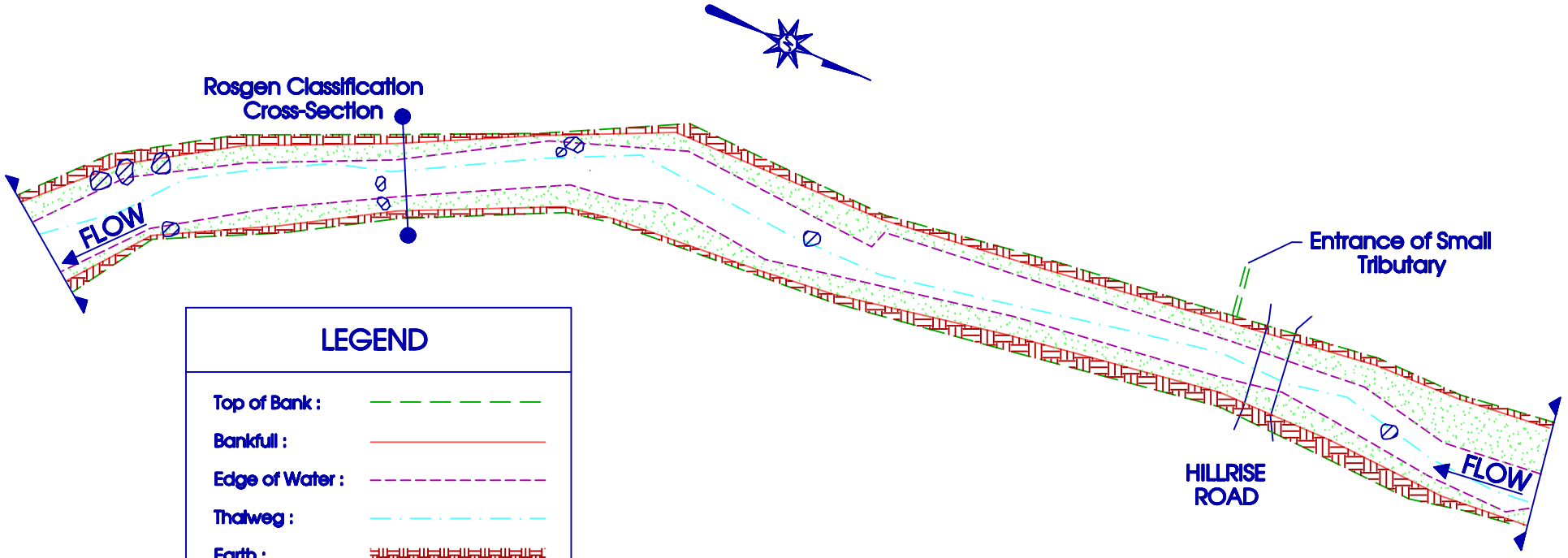
Bankfull Width (ft):	43.60	Mean Bankfull Depth (ft):	1.90
Bankfull Cross-sectional Area (ft^2):	82.93	Maximum Bankfull Depth (ft):	3.12
Hydraulic Radius (ft):	1.78	Wetted Perimeter (ft):	46.47

Long Green Creek at Glen Arm, Maryland

Upstream view of classification cross-section

Right bank of classification cross-section

LONG GREEN CREEK
at Glen Arm, MD
U.S.G.S. Gage: 1584050



LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Boulders :
- Limit of Study Reach:

Scale (ft): 0 50 100 200

Survey Date: 2/19/99
Study Reach Length: 994'
Study Reach 507' D/S of U.S.G.S. Gage

Classification Cross-Section Monument Locations:

Left Monument Location (+/- N/A)	Right Monument Location (+/- 20'):
N/A	39°27'3.08" N
N/A	76°28'37.26" W
Elev. N/A	Elev. 277'

MORGAN RUN AT LOUISVILLE, MD
USGS STATION NUMBER: 1586610

Latitude:	39° 27' 07"	Gage Period of Record:	1982 – Present
Longitude:	76° 57' 20"	Mean Annual Discharge (cfs):	35.00
ADC Map Coordinates:	Carroll / 1990	Rosgen Stream Type:	C4/1
	Map 30 / C1	Survey Date:	Oct. 1997
Drainage Area (sq. mi.):	28.00		Sept. 1998
Stream Order / Magnitude:	5 / 65		
Percent Imperviousness:	4.00		

Land Use (%): Residential: 14.73 Agricultural: 53.52 Forest: 31.20 Commercial: 0.34

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 235.70 $Q_{1.5}$: 850.00 $Q_{2.0}$: 1170.00
(Log-Pearson Period: 1983 - 2000)

General Study Reach Description: The downstream end of the study reach is 322 feet upstream of the gage due to deposition and lateral adjustment from the bridge crossing in the intervening reach. The study reach has pool/riffle features, a bedrock-controlled meander pattern, point and side bar depositional features, some lateral scour, and appears vertically stable. There are several pieces of large woody debris; two extend well into the channel. Numerous boulders and bedrock outcrops occur throughout the reach. The bank and floodplain vegetation is moderately dense forest, consisting of oak, sycamore, tulip poplar, and walnut, with a moderately dense understory, consisting of ironwood and mountain laurel.

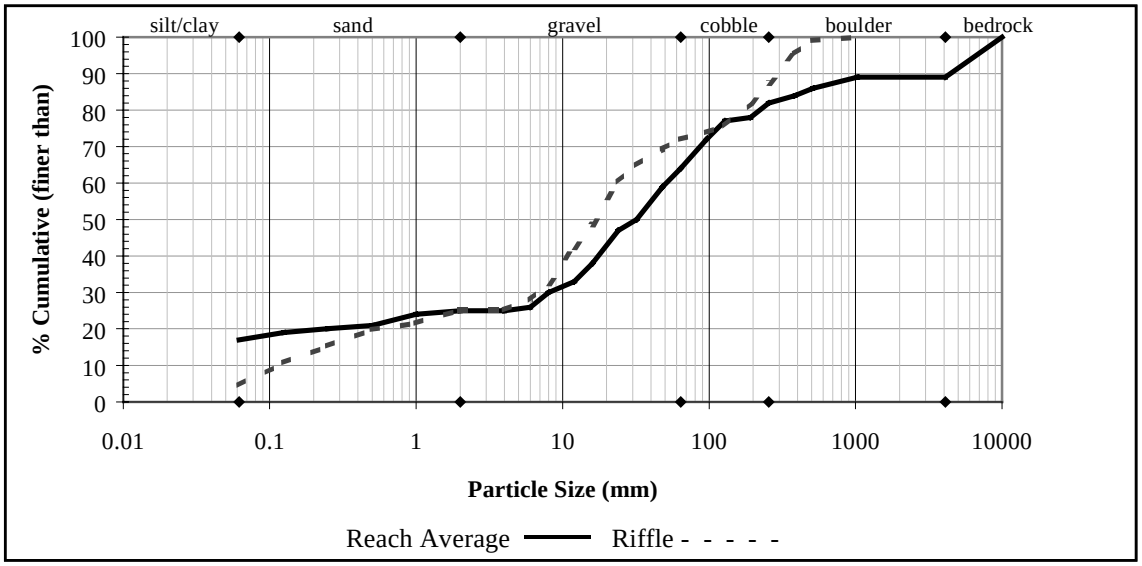
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	1024.00	Q_{bkf} / $Q_{2.0}$:	0.88	
Bankfull Return Interval (R.I.):	1.75	$Q_{Top\ of\ Bank}$(cfs):	2233.00	R.I.: 5.00
Gage Height (ft):	4.82	$Q_{Active\ Channel}$ (cfs):	238.30	R.I.: 1.01
Q_{bkf} / $Q_{1.5}$:	1.20			(SYS)

STUDY REACH SURVEY INFORMATION

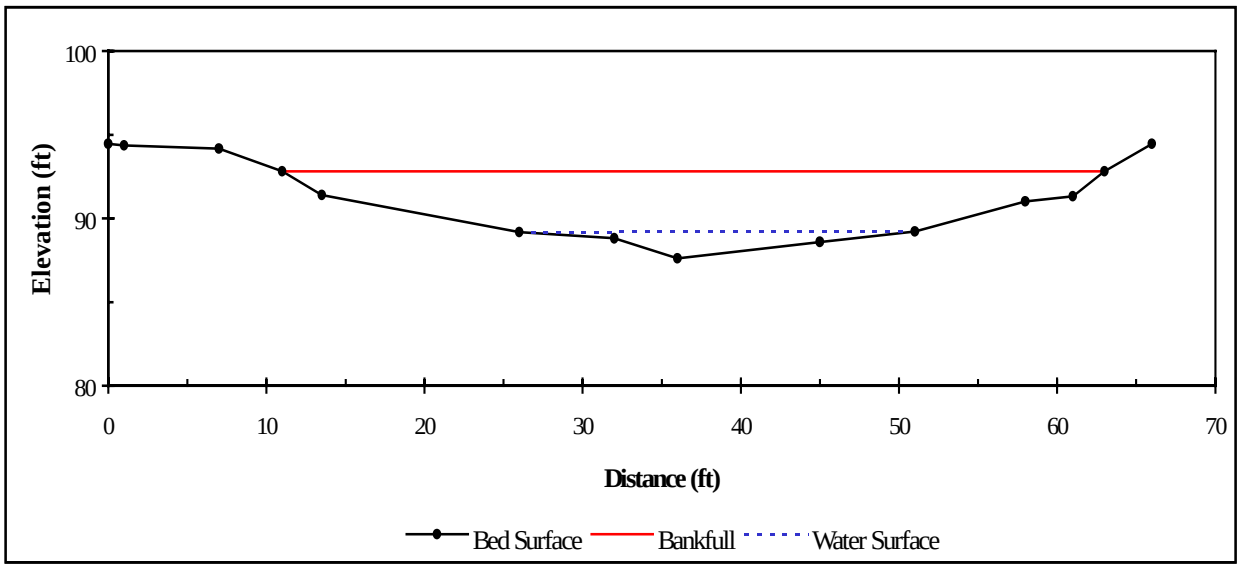
Average Water Surface Slope (ft/ft):	0.0052	Flood-prone Width (ft):	178.00
Manning's "n":	0.037	Entrenchment Ratio:	3.42
Mean Bankfull Velocity (ft/sec):	6.18	Width/Depth Ratio:	16.35
u/u*:	8.58	Channel Sinuosity:	1.18
R/D_{84}:	4.41	Beltwidth:	314
Froude Number:	0.61	Meander Width Ratio:	6.0

MORGAN RUN AT LOUISVILLE, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	0.28
D_{35}	13.46	8.89
D_{50}	32.00	16.77
D_{84}	384.00	213.77
D_{95}	Bedrock	374.60

STUDY REACH CROSS SECTION

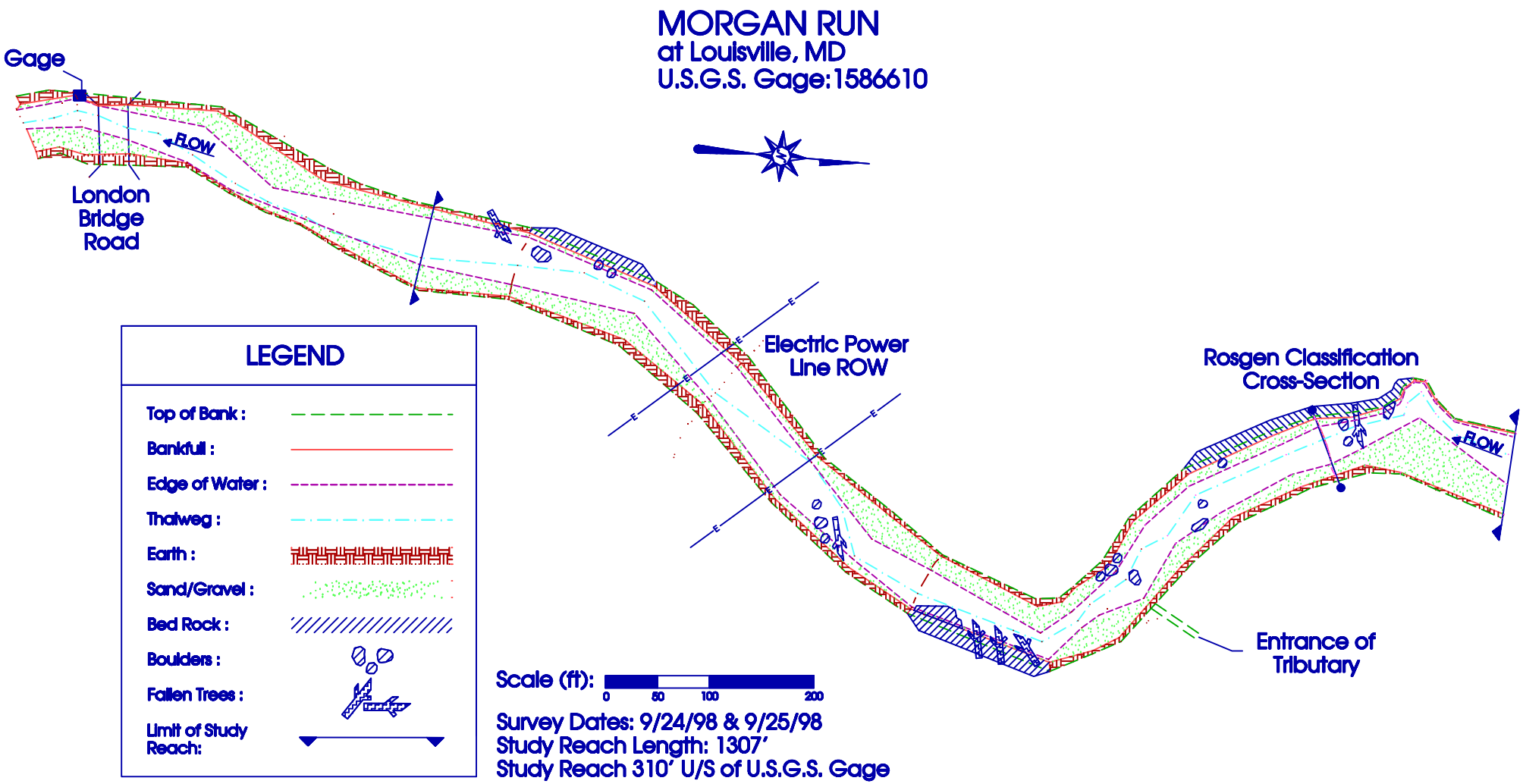


Bankfull Width (ft):	52.00	Mean Bankfull Depth (ft):	3.18
Bankfull Cross-sectional Area (ft^2):	165.58	Maximum Bankfull Depth (ft):	5.20
Hydraulic Radius (ft):	3.09	Wetted Perimeter (ft):	53.57

Morgan Run at Louisville, Maryland

Upstream view of classification cross-section

Left bank of classification cross-section


MORGAN RUN
at Louisville, MD
U.S.G.S. Gage:1586610
Gage
London Bridge Road
FLOW
Electric Power Line ROW
Rosgen Classification Cross-Section
FLOW
Entrance of Tributary
LEGEND
Top of Bank :
Bankfull :
Edge of Water :
Thalweg :
Earth :
Sand/Gravel :
Bed Rock :
Boulders :
Fallen Trees :
Limit of Study Reach:
Scale (ft):
0
50
100
200
Survey Dates: 9/24/98 & 9/25/98
Study Reach Length: 1307'
Study Reach 310' U/S of U.S.G.S. Gage

NORTHEAST CREEK AT LESLIE, MD
USGS STATION NUMBER: 1496000

Latitude:	39° 37' 38"	Gage Period of Record:	1948 - 1984
Longitude:	75° 56' 40"	Mean Annual Discharge (cfs):	35.70
ADC Map Coordinates:	Cecil / 1989	Rosgen Stream Type:	C2/1
	Map 11 / E5	Survey Date:	Sept. 1997
Drainage Area (sq. mi.):	24.30		Oct. 1998
Stream Order / Magnitude:	3 / 30		
Percent Imperviousness:	2.85		

Land Use (%): Residential: 5.47 Agricultural: 72.22 Forest: 18.78 Commercial: 1.79

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 535.70 $Q_{1.5}$: 1200.00 $Q_{2.0}$: 1502.80
(Log-Pearson Period: 1949 - 1984)

General Study Reach Description: The study reach and gage reach are the same. The reach has both step/pool and riffle/pool features, a regular bedrock-controlled meander pattern with slightly developed point bar depositional features, and is stabilized vertically by bedrock outcrops. There is little or no large woody debris, but numerous boulders and bedrock outcrops occur throughout the reach. The bank and floodplain vegetation are moderately dense forest, consisting of tulip poplar, beech, oak, ironwood, and red maple, with a moderately dense understory of mountain laurel and rhododendron.

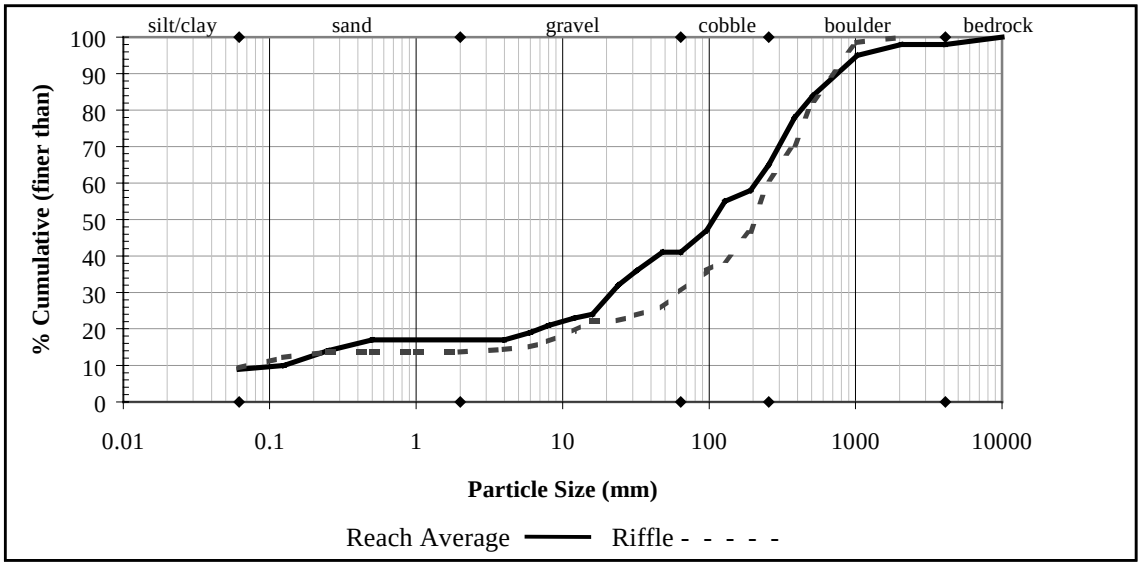
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	1336.00	Q_{bkf} / $Q_{2.0}$:	0.89	
Bankfull Return Interval (R.I.):	1.67	$Q_{Top\ of\ Bank}$(cfs):	2386.00	R.I.: 5.50
Gage Height (ft):	4.72	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	1.11			

STUDY REACH SURVEY INFORMATION

Average Water Surface Slope (ft/ft):	0.0120	Flood-prone Width (ft):	181.00
Manning's "n":	0.052	Entrenchment Ratio:	3.12
Mean Bankfull Velocity (ft/sec):	6.76	Width/Depth Ratio:	17.01
u/u*:	6.14	Channel Sinuosity:	1.11
R/D_{84}:	1.77	Beltwidth:	430
Froude Number:	0.65	Meander Width Ratio:	7.4

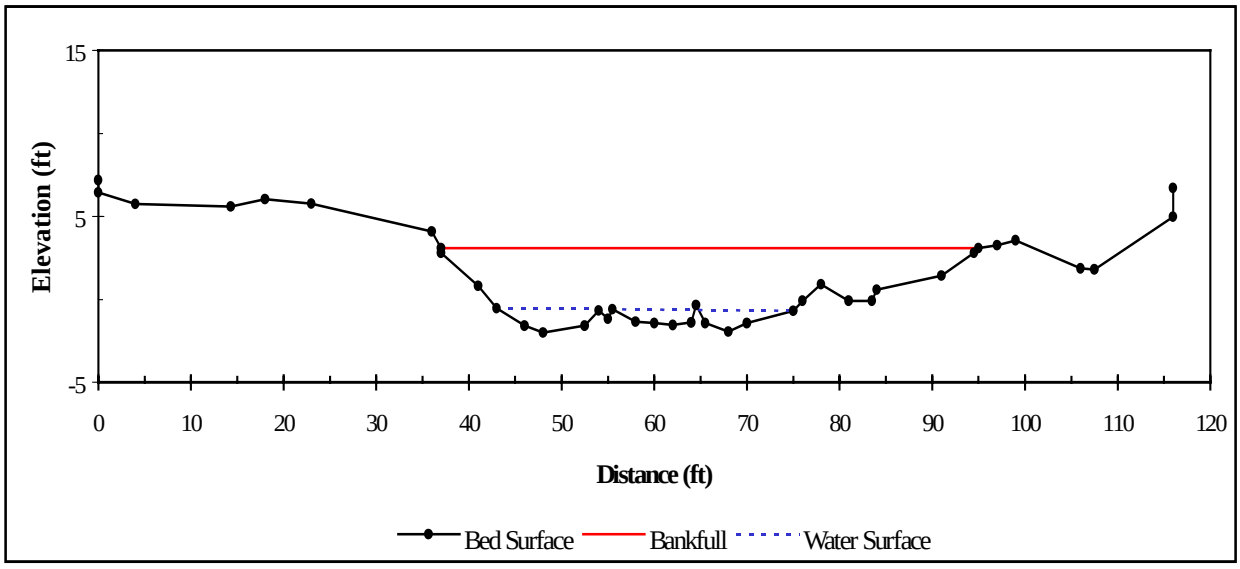
NORTHEAST CREEK AT LESLIE, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	0.40	7.17
D_{35}	29.78	89.65
D_{50}	106.94	204.84
D_{84}	512.00	541.19
D_{95}	1024.00	876.13

The reach pebble count distribution is skewed. The reach pebble count D_{50} is cobble. The largest number of observations is in the boulder size class. The riffle pebble count D_{50} is cobble.

STUDY REACH CROSS SECTION



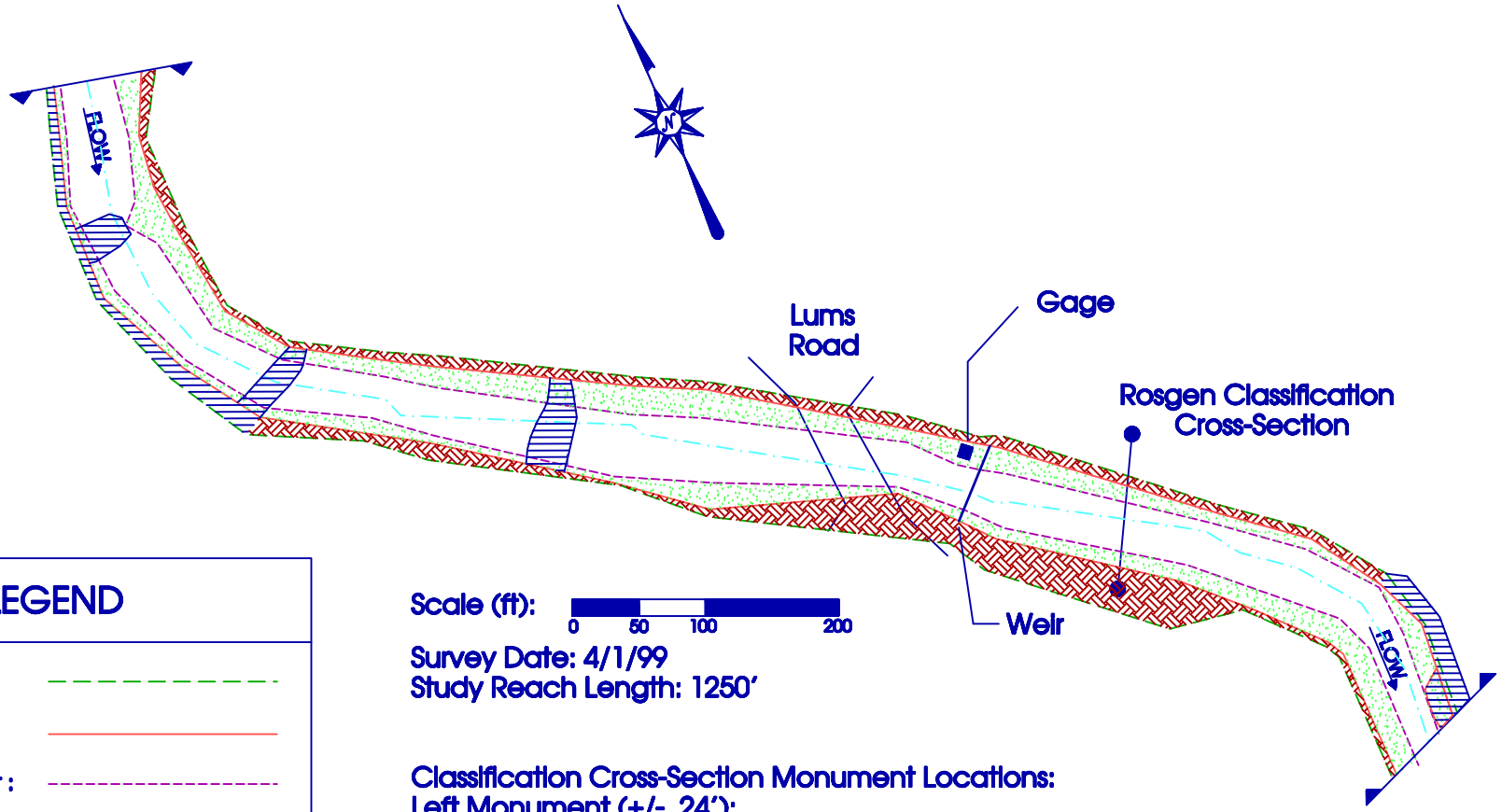
Bankfull Width (ft):	58.00	Mean Bankfull Depth (ft):	3.41
Bankfull Cross-sectional Area (ft^2):	197.62	Maximum Bankfull Depth (ft):	5.09
Hydraulic Radius (ft):	3.15	Wetted Perimeter (ft):	62.75

Northeast Creek at Leslie, Maryland

Upstream view of classification cross-section

Left bank of classification cross-section

NORTHEAST CREEK
at Leslie, MD
U.S.G.S. Gage: 01496000



LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Bed Rock :
- Limit of Study Reach:

Scale (ft): 0 50 100 200

Survey Date: 4/1/99
Study Reach Length: 1250'

Classification Cross-Section Monument Locations:
Left Monument (+/- 24'):
39° 37' 38.28" N
75° 56' 37.71" W
Elevation: 325'

Right Monument (+/- 41'):
39° 37' 36.95" N
75° 56' 38.27" W
Elevation: 322'

NORTHWEST BRANCH ANACOSTIA RIVER NEAR COLESVILLE, MD
USGS STATION NUMBER: 1650500

Latitude:	39° 03' 55"	Gage Period of Record:	1924 - 1983
Longitude:	77° 01' 48"		1997 - Present
ADC Map Coordinates:	Montgomery / 1998	Mean Annual Discharge (cfs):	22.50
	Map 31/A9-10	Rosgen Stream Type:	E5/1
Drainage Area (sq. mi.):	21.10	Survey Date:	Oct. 1998
Stream Order / Magnitude:	4 / 47		Dec. 1998
Percent Imperviousness:	16.53		

Land Use (%): Residential: 38.62 Agricultural: 24.35 Forest: 28.80 Commercial: 4.75

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 447.60 $Q_{1.5}$: 960.00 $Q_{2.0}$: 1227.00
(Log-Pearson Period: 1924 - 1983)

General Study Reach Description: The study reach and gage reach are the same. The study reach has run/pool features, a bedrock and boulder revetment controlled meander pattern with minor depositional features, some lateral scour, and is stabilized vertically by bedrock outcrops in the bed. There is no large woody debris in the reach. The bank vegetation is moderately dense forest of box elder, silver maple and sycamore. On the left, the floodplain is old-field with recently planted trees, while the right floodplain is covered by moderately dense forest with a moderately dense understory of sapling trees and spicebush. Immediately upstream of the reach, the stream passes through a 3-cell box culvert, and an abandoned bridge crosses the channel at the downstream end of the reach. The reach appears to have been straightened at some time in the past, and the reach immediately downstream was channelized in the 1930s, according to the USGS gage record.

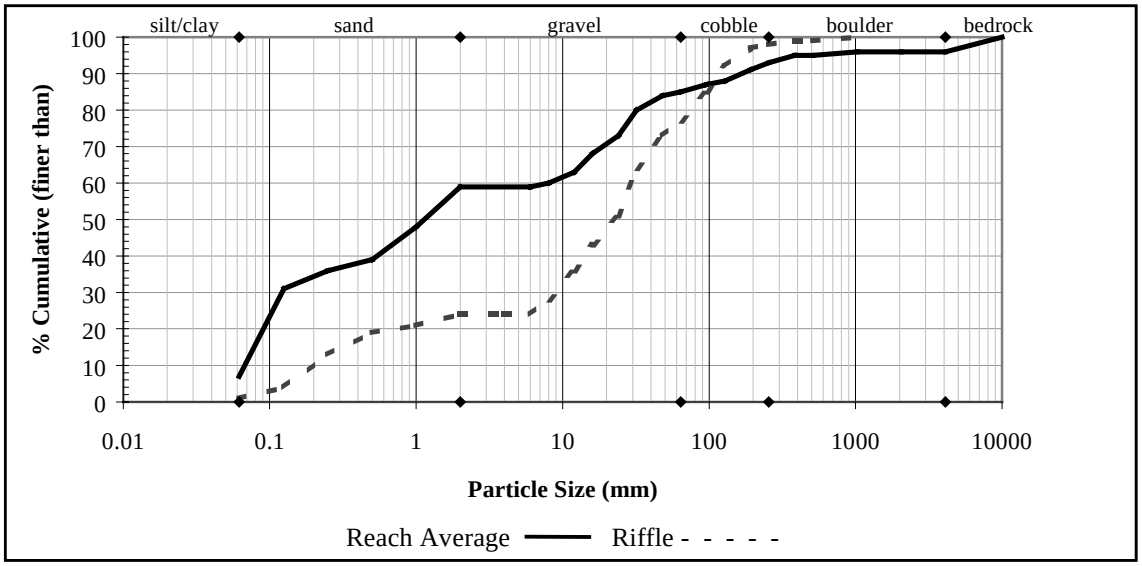
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	907.00	Q_{bkf} / $Q_{2.0}$:	0.74	
Bankfull Return Interval (R.I.):	1.43	$Q_{Top\ of\ Bank}$(cfs):	1081.00	R.I.: 1.60
Gage Height (ft):	6.47	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	0.94			

STUDY REACH SURVEY INFORMATION

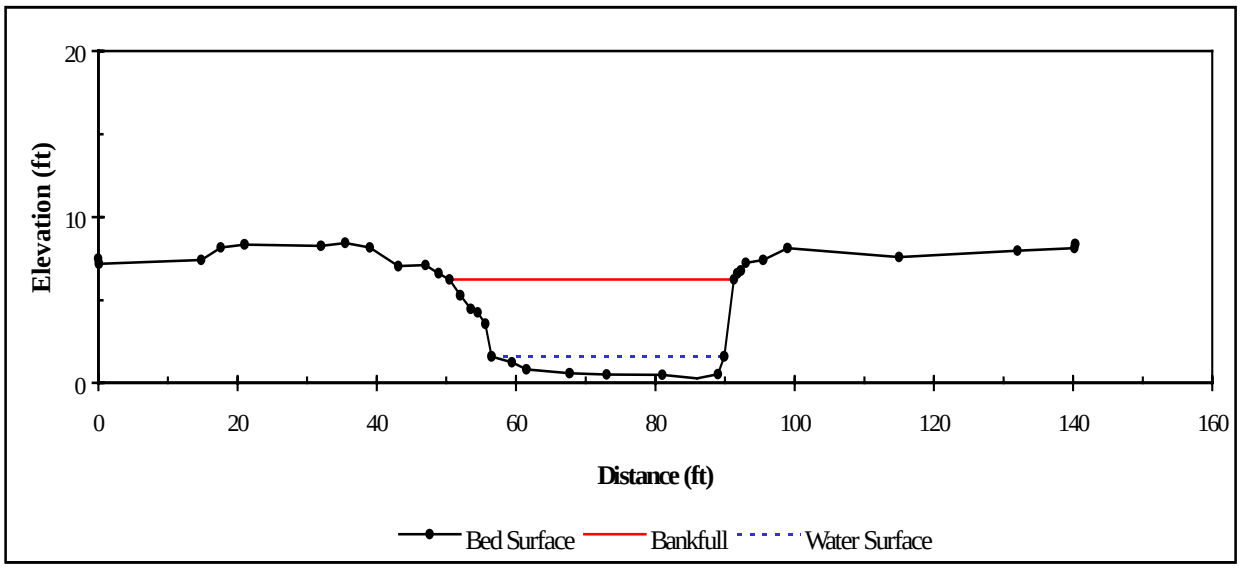
Average Water Surface Slope (ft/ft):	0.0017	Flood-prone Width (ft):	601.00
Manning's "n":	0.036	Entrenchment Ratio:	14.71
Mean Bankfull Velocity (ft/sec):	4.52	Width/Depth Ratio:	8.32
u/u*:	9.42	Channel Sinuosity:	1.06
R/D_{84}:	14.31	Beltwidth:	79
Froude Number:	0.36	Meander Width Ratio:	1.9

NORTHWEST BRANCH ANACOSTIA RIVER NEAR COLESVILLE, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	0.08	0.35
D_{35}	0.22	11.41
D_{50}	1.13	22.81
D_{84}	48.00	91.26
D_{95}	512.00	163.25

STUDY REACH CROSS SECTION



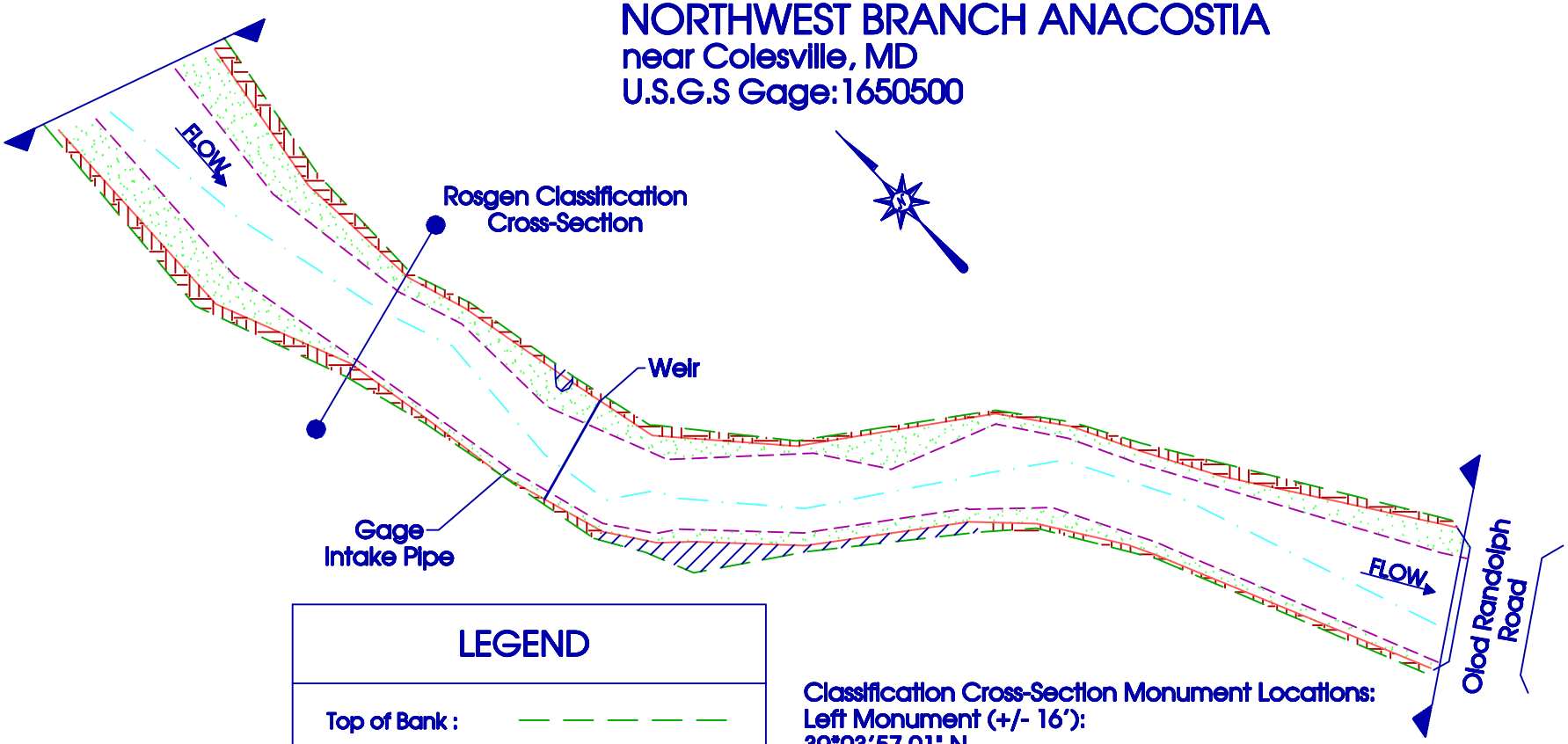
Bankfull Width (ft):	40.85	Mean Bankfull Depth (ft):	4.91
Bankfull Cross-sectional Area (ft^2):	200.68	Maximum Bankfull Depth (ft):	5.97
Hydraulic Radius (ft):	4.28	Wetted Perimeter (ft):	46.84

Northwest Branch of the Anacostia River near Colesville, Maryland

Downstream view of classification cross-section

Right bank of classification cross-section

NORTHWEST BRANCH ANACOSTIA
near Colesville, MD
U.S.G.S Gage:1650500



LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Bed Rock :
- Limit of Study Reach:

Classification Cross-Section Monument Locations:
Left Monument (+/- 16'):
39°03'57.01" N
77°01'44.81" W
Elevation: 257'

Right Monument (+/- 20'):
39°03'56.69" N
77°01'46.63" W
Elevation: 302'

Scale (ft): 0 50 100 200

Survey Date:12/22/98
Study Reach Length: 646'

PATUXENT RIVER NEAR UNITY, MD
USGS STATION NUMBER: 1591000

Latitude:	39° 14' 18"	Gage Period of Record:	1944 - Present
Longitude:	77° 03' 23"	Mean Annual Discharge (cfs):	39.40
ADC Map Coordinates:	Montgomery / 1998 Map 12 / G4	Rosgen Stream Type:	C4
		Survey Date:	Oct. 1997 Jan. 1999
Drainage Area (sq. mi.):	34.80		
Stream Order / Magnitude:	4 / 64		
Percent Imperviousness:	2.14		

Land Use (%): Residential: 5.96 Agricultural: 56.84 Forest: 36.15 Commercial: 0.79

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 284.80 $Q_{1.5}$: 1050.00 $Q_{2.0}$: 1495.10
(Log-Pearson Period: 1945 - 1995)

General Study Reach Description: The downstream end of the study reach is 2,500 feet upstream of the gage because of a long intervening reach of divided channel, and potential reservoir backwater effects below the gage. The reach has pool/riffle features, a regular meander pattern with point, side, and mid-channel bars (the latter associated with debris blockages), some lateral scour, and appears vertically stable. There are several pieces of large woody debris, some span or greatly block the channel, and numerous boulders throughout the reach. The bank vegetation is mature red maple and sycamore, while the floodplain vegetation is a mix of pasture and forest with a sparse to moderately dense understory.

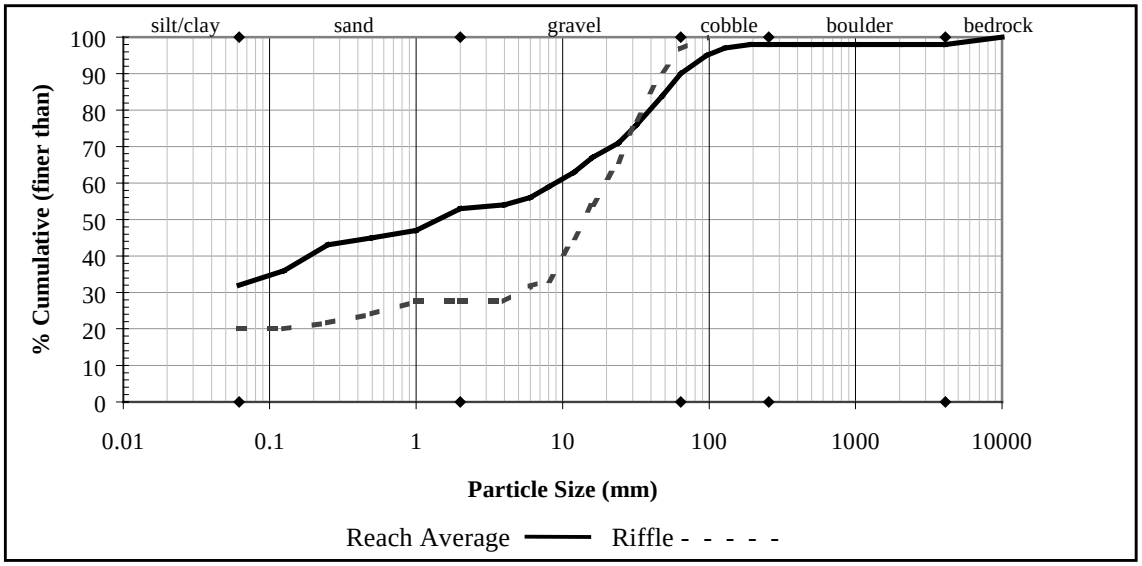
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	1045.00	Q_{bkf} / $Q_{2.0}$:	0.70	
Bankfull Return Interval (R.I.):	1.50	$Q_{Top\ of\ Bank}$(cfs):	1777.00	R.I.: 2.40
Gage Height (ft):	6.10	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	1.00			

STUDY REACH SURVEY INFORMATION

Average Water Surface Slope (ft/ft):	0.0021	Flood-prone Width (ft):	428.00
Manning's "n":	0.030	Entrenchment Ratio:	8.23
Mean Bankfull Velocity (ft/sec):	5.17	Width/Depth Ratio:	13.37
u/u*:	10.77	Channel Sinuosity:	1.26
R/D_{84}:	26.88	Beltwidth:	310
Froude Number:	0.46	Meander Width Ratio:	6.0

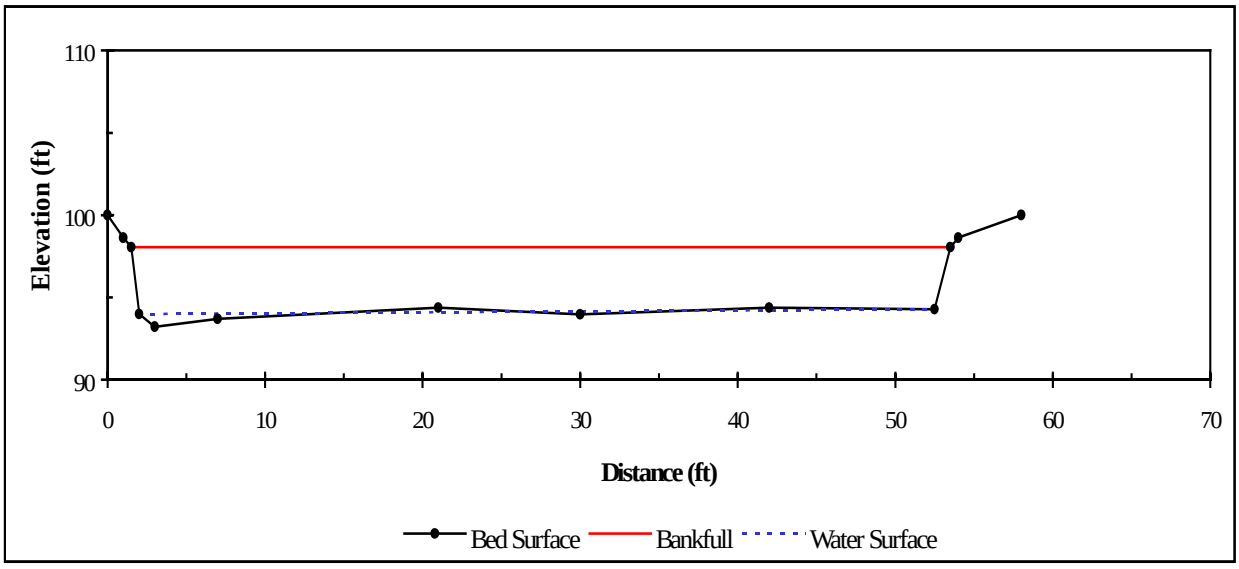
PATUXENT RIVER NEAR UNITY, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	n/a
D_{35}	0.10	8.48
D_{50}	1.41	14.04
D_{84}	48.00	38.99
D_{95}	96.00	58.95

The reach pebble count distribution is bi-modal (silt/clay and gravel). The largest number of oberservations is in the gravel size class. The riffle pebble count D_{50} is gravel.

STUDY REACH CROSS SECTION



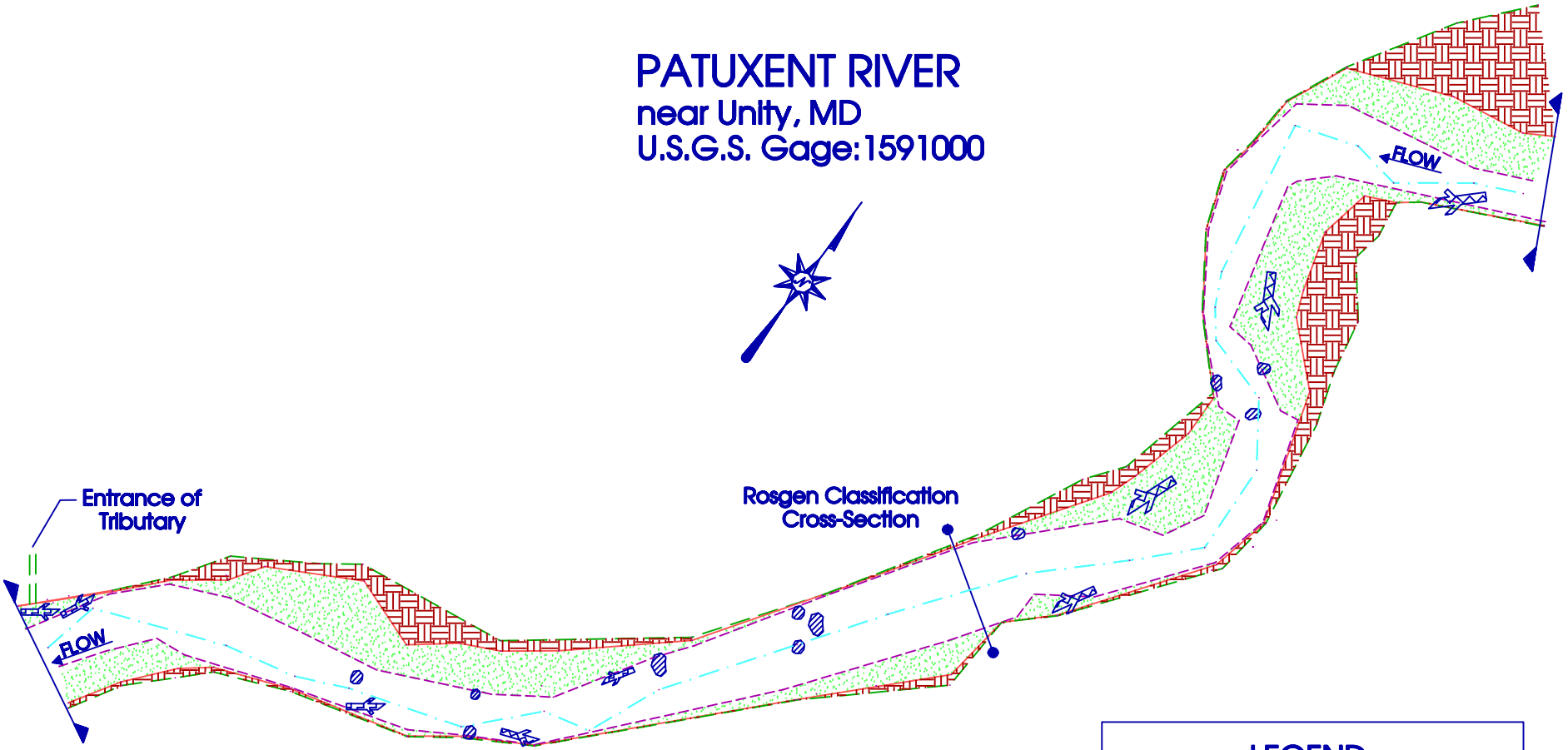
Bankfull Width (ft):	52.00	Mean Bankfull Depth (ft):	3.89
Bankfull Cross-sectional Area (ft^2):	202.20	Maximum Bankfull Depth (ft):	4.82
Hydraulic Radius (ft):	3.44	Wetted Perimeter (ft):	58.80

Patuxent River near Unity, Maryland

Upstream view of classification cross-section

Left bank of classification cross-section

PATUXENT RIVER
near Unity, MD
U.S.G.S. Gage:1591000



Scale (ft): 0 50 100 200

Survey Dates:1/26/99 & 1/27/99
Study Reach Length; 1243'
Study Reach 2498' U/S of U.S.G.S. Gage

LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Boulders :
- Fallen Trees :
- Limit of Study Reach:

PINEY CREEK NEAR TANEYTOWN, MD
USGS STATION NUMBER: 1639140

Latitude:	39° 39' 38"	Gage Period of Record:	1990 - Present
Longitude:	77° 13' 16"	Mean Annual Discharge (cfs):	40.40
ADC Map Coordinates:	Carroll / 1990	Rosgen Stream Type:	C4/1
	Map 9 / C2	Survey Date:	Oct. 1998
Drainage Area (sq. mi.):	31.30		Dec. 1998
Stream Order / Magnitude:	4 / 44		
Percent Imperviousness:	3.96		

Land Use (%): Residential: 8.37 Agricultural: 79.22 Forest: 10.64 Commercial: 1.74

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: n/a $Q_{1.5}$: 1525.00 $Q_{2.0}$: 1930.00
(Log-Pearson Period: 1990 - 1998)

General Study Reach Description: The study reach and the gage reach are the same. The reach has pool/riffle features, a bedrock-controlled meander pattern with point and side bar depositional features, some lateral scour, and is stabilized vertically by bedrock outcrops. There is no large woody debris in the reach. The bank vegetation is mature green ash, red maple and sycamore. On the left and on the downstream right, the floodplain vegetation is mature forest with moderately dense understory of shrubs and sapling trees, while the floodplain vegetation on the upper right is pasture. Cattle have unrestricted access to the channel over the entire reach. Upstream of the study reach the channel appears to have been straightened at some time in the past. Roop Road crosses the channel on a bridge at the lower end of the reach.

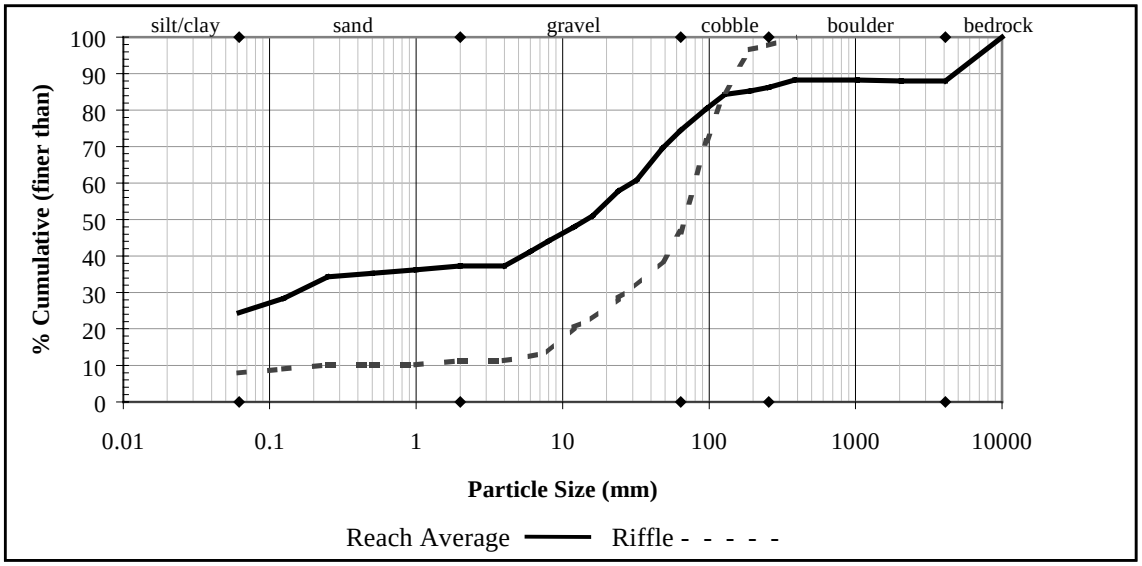
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	1389.00	Q_{bkf} / $Q_{2.0}$:	0.72	
Bankfull Return Interval (R.I.):	1.40	$Q_{Top\ of\ Bank}$(cfs):	1949.00	R.I.: 2.00
Gage Height (ft):	5.94	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	0.91			

STUDY REACH SURVEY INFORMATION

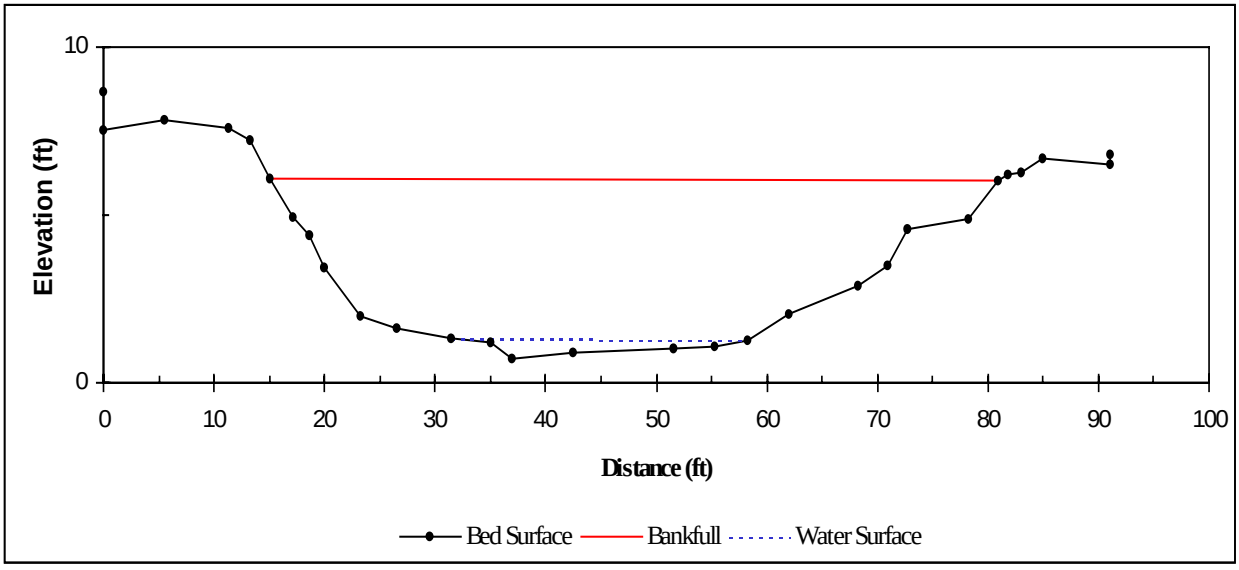
Average Water Surface Slope (ft/ft):	0.0025	Flood-prone Width (ft):	600.00
Manning's "n":	0.032	Entrenchment Ratio:	9.12
Mean Bankfull Velocity (ft/sec):	5.58	Width/Depth Ratio:	17.41
u/u*:	10.33	Channel Sinuosity:	1.47
R/D_{84}:	8.99	Beltwidth:	334
Froude Number:	0.51	Meander Width Ratio:	5.1

PINEY CREEK NEAR TANEYTOWN, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	9.21
D_{35}	0.41	38.67
D_{50}	14.54	67.64
D_{84}	125.09	124.73
D_{95}	Bedrock	181.40

STUDY REACH CROSS SECTION



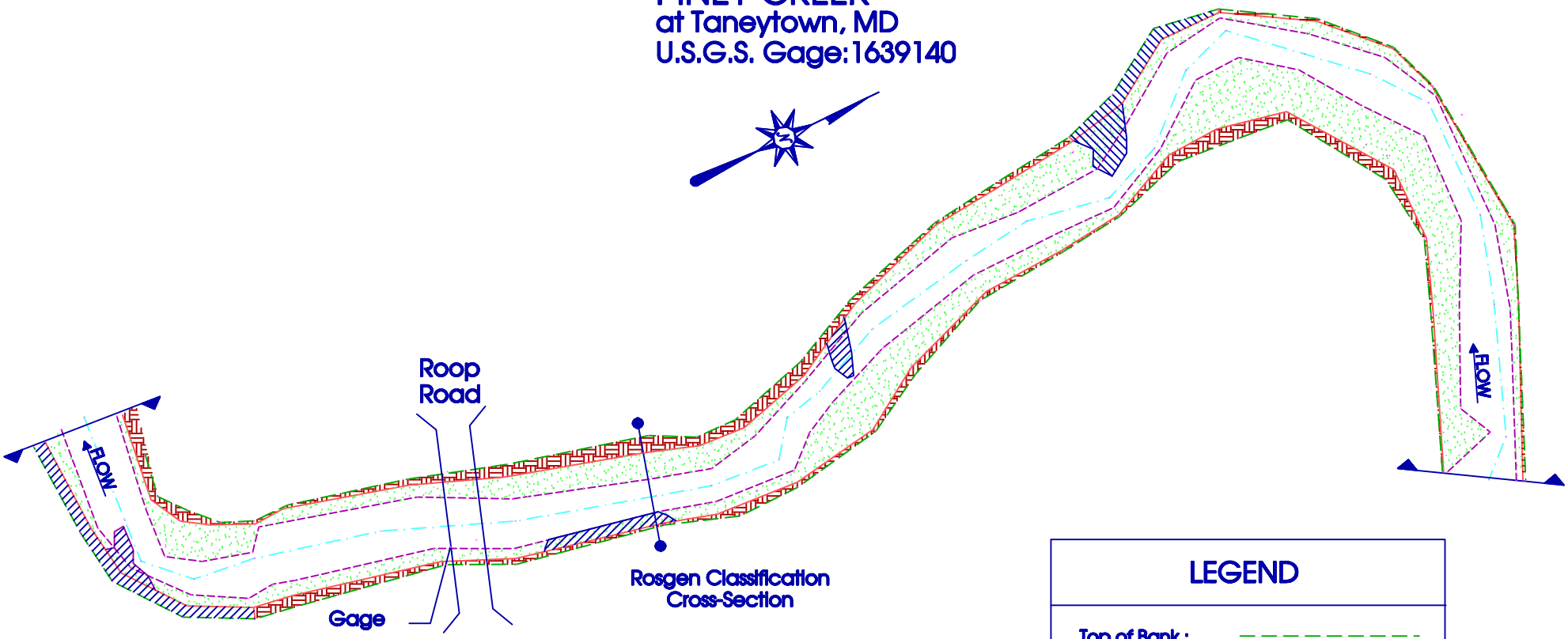
Bankfull Width (ft):	65.80	Mean Bankfull Depth (ft):	3.78
Bankfull Cross-sectional Area (ft^2):	248.90	Maximum Bankfull Depth (ft):	5.36
Hydraulic Radius (ft):	3.68	Wetted Perimeter (ft):	67.68

Piney Creek at Taneytown, Maryland

Downstream view of classification cross-section

Left bank of classification cross-section

PINEY CREEK
at Taneytown, MD
U.S.G.S. Gage:1639140



Scale (ft): 0 50 100 200

Survey Dates: 12/29/98 & 12/30/98
Study Reach Length: 1784'

Classification Cross-Section Monument Locations:

Left Monument (+/- 15'):	Right Monument (+/- 12):
39° 39' 40.63" N	39° 39' 40.33" N
77° 13' 13.97" W	77° 13' 15.17" W
Elevation 462'	Elevation 419'

LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Bed Rock :
- Limit of Study Reach:

SENECA CREEK AT DAWSONVILLE, MD
USGS STATION NUMBER: 1645000

Latitude:	39° 07' 41"	Gage Period of Record:	1930 - Present
Longitude:	77° 20' 13"	Mean Annual Discharge (cfs):	109.00
ADC Map Coordinates:	Montgomery / 1998 Map 17 / E11	Rosgen Stream Type:	C4
		Survey Date:	Nov. 1997
Drainage Area (sq. mi.):	101.00		
Stream Order / Magnitude:	5 / 189		
Percent Imperviousness:	12.04		

Land Use (%): Residential: 20.35 Agricultural: 42.48 Forest: 28.72 Commercial: 5.03

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 831.20 $Q_{1.5}$: 3050.00 $Q_{2.0}$: 4322.00
(Log-Pearson Period: 1968 - 1998)

General Study Reach Description: The upstream end of the study reach is 103 feet downstream of the gage, the channel forks a few hundred feet upstream of the gage. The study reach has pool/riffle features, a straight meander pattern with point and side bars, some lateral scour, and appears vertically stable. There are several pieces of large woody debris in the reach, but none that extend across or well into the channel. The bank vegetation is forest, consisting of sycamore, river birch and ironwood with a low-density understory, while the floodplain vegetation is mostly pasture/hay field.

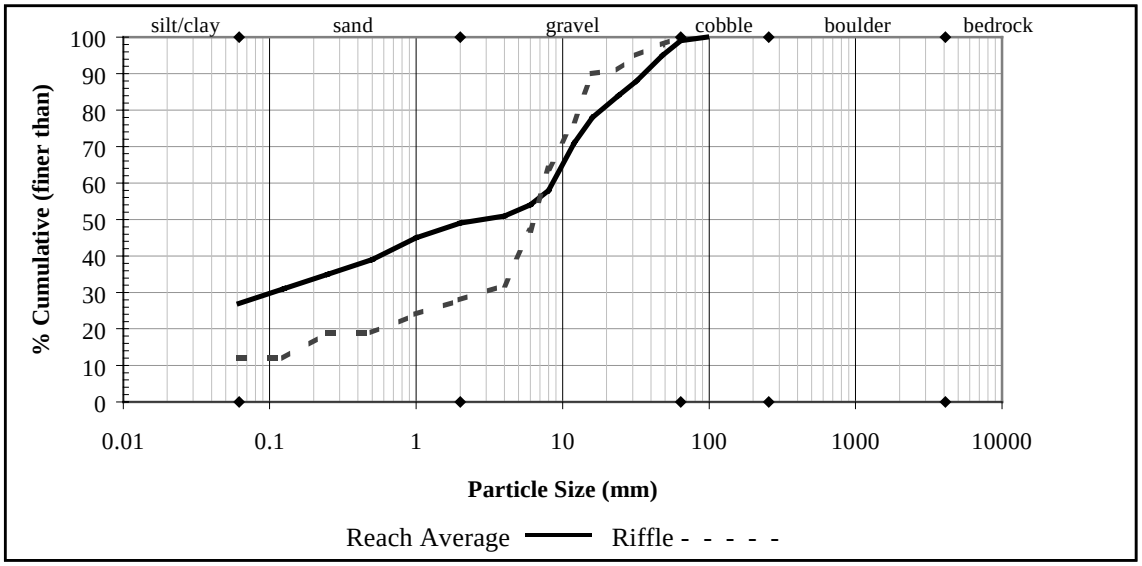
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	2562.00	Q_{bkf} / $Q_{2.0}$:	0.59	
Bankfull Return Interval (R.I.):	1.33	$Q_{Top\ of\ Bank}$(cfs):	n/a	R.I.: n/a
Gage Height (ft):	7.53	$Q_{Active\ Channel}$ (cfs):	761.20	R.I.: <1.005
Q_{bkf} / $Q_{1.5}$:	0.84			

STUDY REACH SURVEY INFORMATION

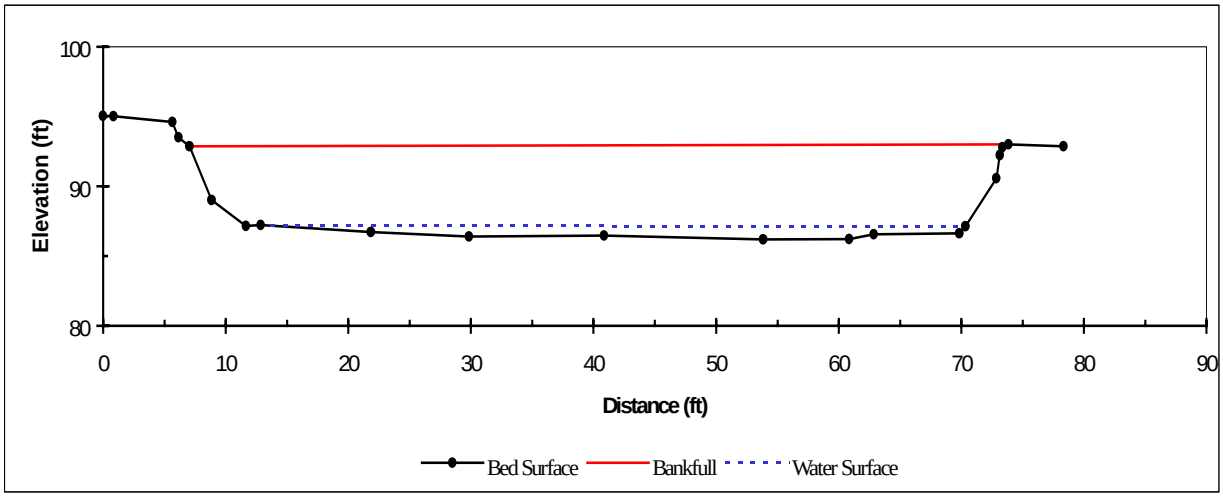
Average Water Surface Slope (ft/ft):	0.0014	Flood-prone Width (ft):	803.00
Manning's "n":	0.027	Entrenchment Ratio:	12.02
Mean Bankfull Velocity (ft/sec):	6.38	Width/Depth Ratio:	11.11
u/u*:	12.76	Channel Sinuosity:	1.05
R/D_{84}:	118.53	Beltwidth:	99
Froude Number:	0.46	Meander Width Ratio:	1.5

SENECA CREEK AT DAWSONVILLE, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	0.19
D_{35}	0.25	4.34
D_{50}	2.83	6.31
D_{84}	24.00	14.01
D_{95}	48.00	32.00

STUDY REACH CROSS SECTION

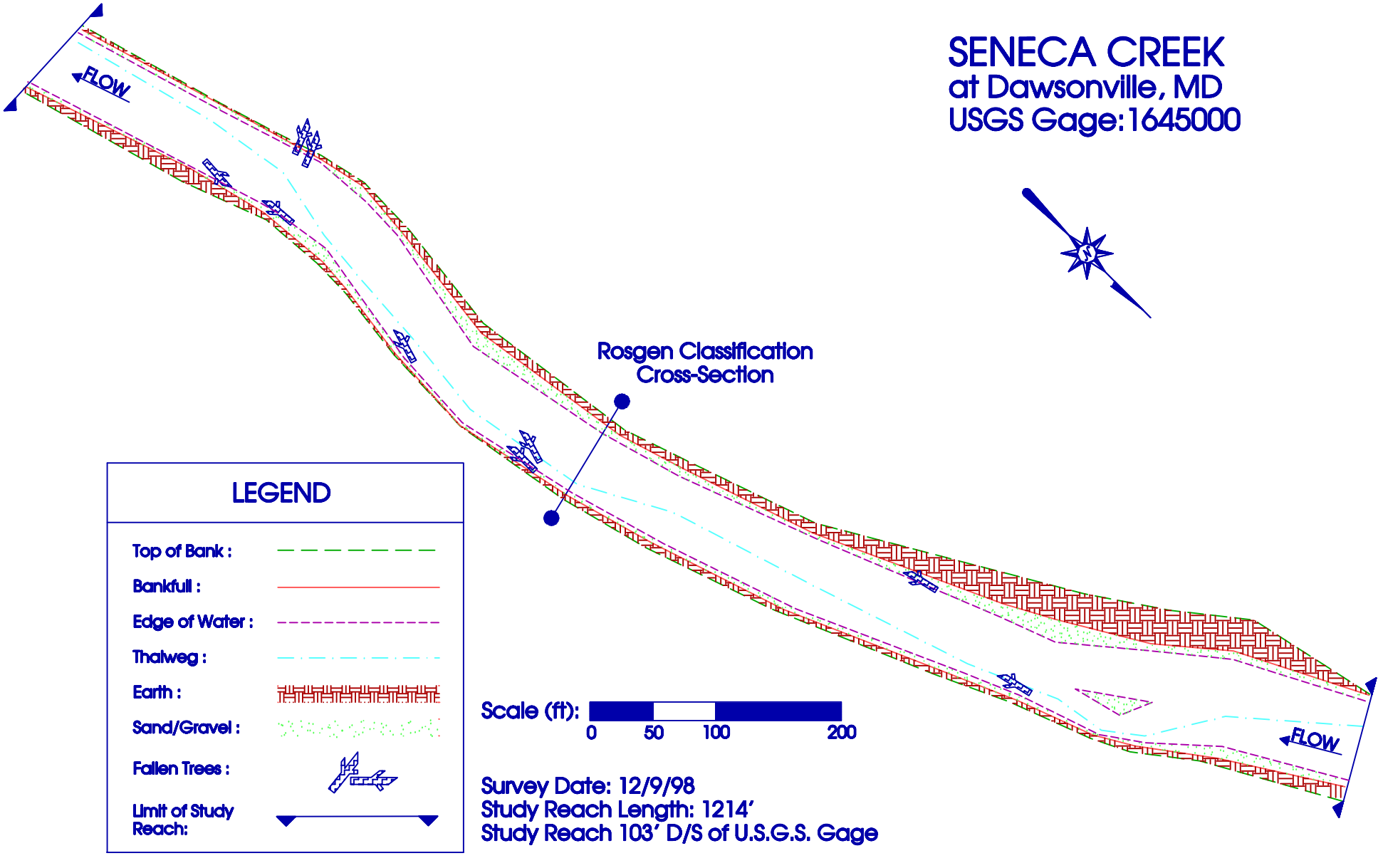


Bankfull Width (ft):	66.80	Mean Bankfull Depth (ft):	6.01
Bankfull Cross-sectional Area (ft^2):	401.37	Maximum Bankfull Depth (ft):	6.72
Hydraulic Radius (ft):	5.45	Wetted Perimeter (ft):	73.67

Seneca Creek at Dawnsonville, Maryland

Upstream view of classification cross-section

Right bank of classification cross-section


SENECA CREEK
at Dawsonville, MD
USGS Gage:1645000
FLOW
Rosgen Classification
Cross-Section
LEGEND
Top of Bank :
Bankfull :
Edge of Water :
Thalweg :
Earth :
Sand/Gravel :
Fallen Trees :
Limit of Study Reach:
Scale (ft):
0
50
100
200
FLOW
Survey Date: 12/9/98
Study Reach Length: 1214'
Study Reach 103' D/S of U.S.G.S. Gage

SLADE RUN NEAR GLYNDON, MD
USGS STATION NUMBER: 1583000

Latitude:	39° 29' 40"	Gage Period of Record:	1947 – 1981
Longitude:	76° 47' 45"	Mean Annual Discharge (cfs):	2.40
ADC Map Coordinates:	Baltimore / 1993	Rosgen Stream Type:	E4
	Map 16 / E-F2	Survey Date:	June 1998
Drainage Area (sq. mi.):	2.09		Oct. 1998
Stream Order / Magnitude:	2 / 5		
Percent Imperviousness:	7.87		

Land Use (%): Residential: 5.66 Agricultural: 44.65 Forest: 42.13 Commercial: 7.55

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 46.30 $Q_{1.5}$: 125.00 $Q_{2.0}$: 154.40
(Log-Pearson Period: 1948 - 1981)

General Study Reach Description: The study reach and gage reach are the same. The reach has pool/riffle features, a regular meander pattern with no bar depositional features, little lateral scour, and appears vertically stable. There is no large woody debris in the reach. The bank vegetation is willow and alder shrub with scattered trees, while the floodplain vegetation is pasture. Livestock have unrestricted access to the stream channel.

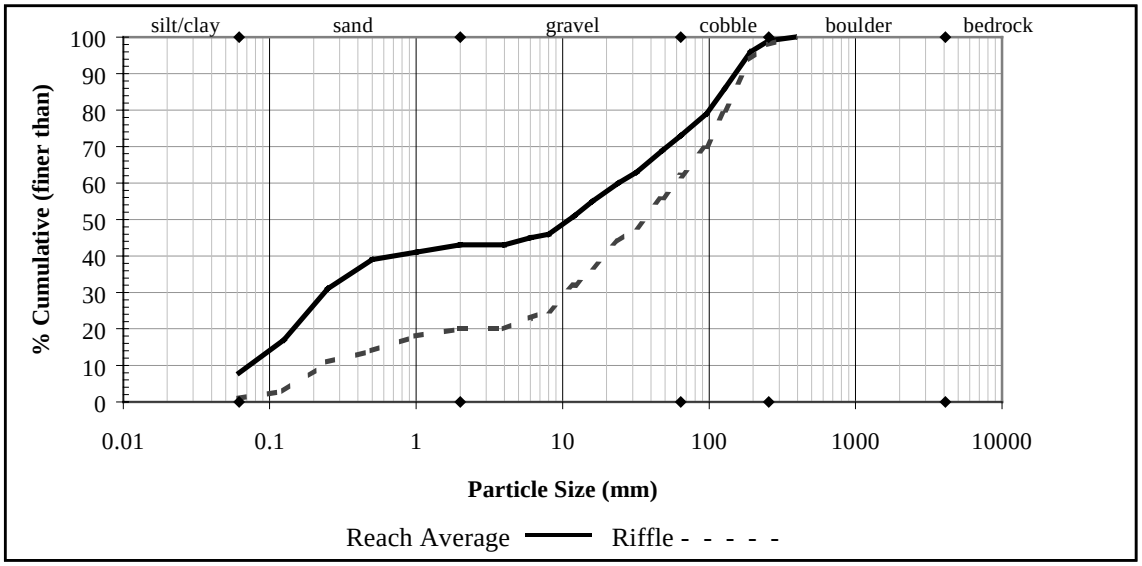
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	114.80	Q_{bkf} / $Q_{2.0}$:	0.74	
Bankfull Return Interval (R.I.):	1.40	$Q_{Top\ of\ Bank}$(cfs):	240.80	R.I.: 4.60
Gage Height (ft):	3.54	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	0.92			

STUDY REACH SURVEY INFORMATION

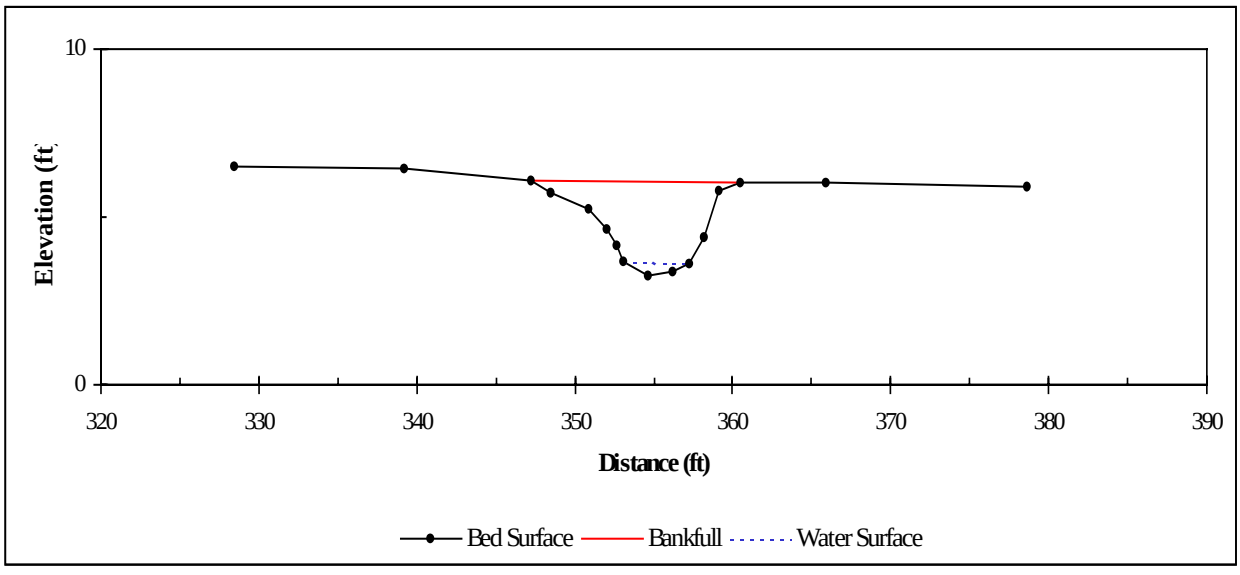
Average Water Surface Slope (ft/ft):	0.0120	Flood-prone Width (ft):	446.00
Manning's "n":	0.043	Entrenchment Ratio:	33.76
Mean Bankfull Velocity (ft/sec):	5.99	Width/Depth Ratio:	9.11
u/u*:	6.30	Channel Sinuosity:	1.07
R/D_{84}:	2.71	Beltwidth:	25
Froude Number:	0.88	Meander Width Ratio:	1.9

SLADE RUN NEAR GLYNDON, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	0.11	0.71
D_{35}	0.35	14.26
D_{50}	10.69	35.41
D_{84}	119.46	143.72
D_{95}	186.52	206.32

STUDY REACH CROSS SECTION



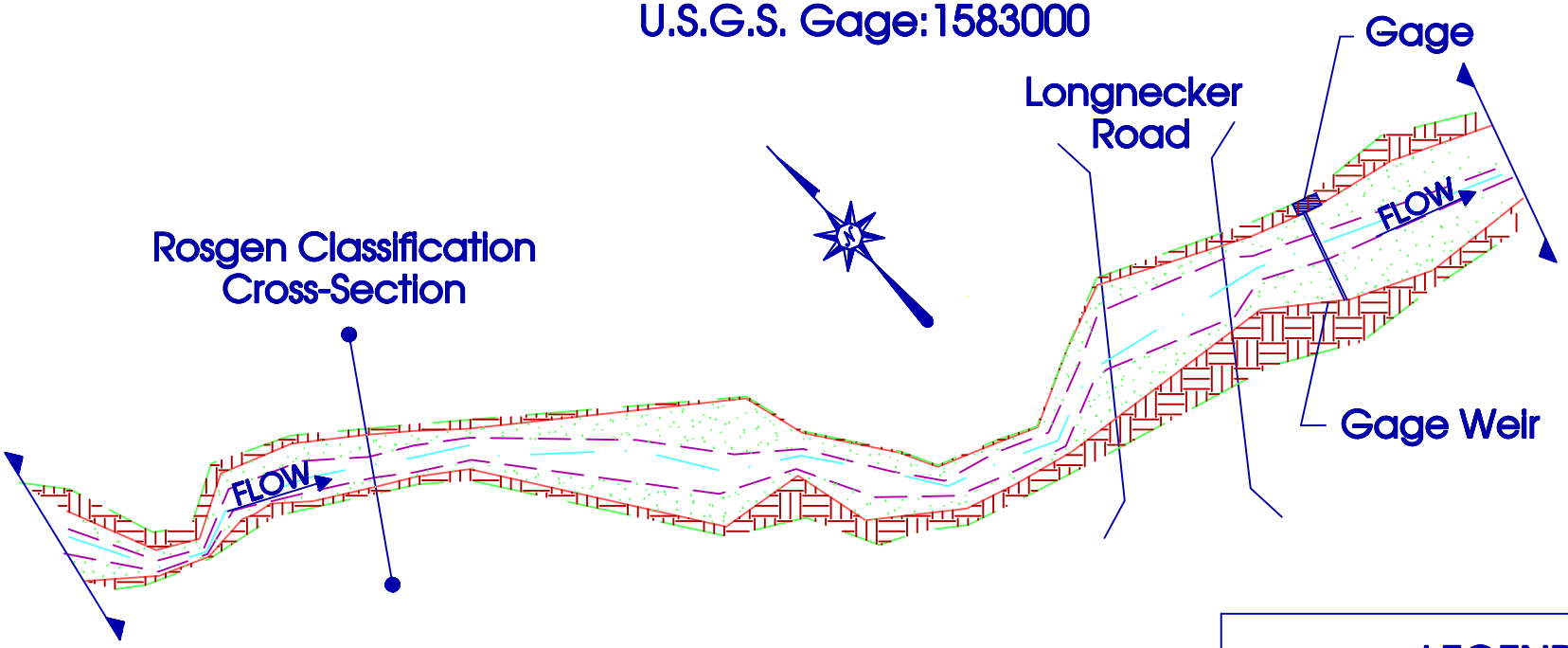
Bankfull Width (ft):	13.21	Mean Bankfull Depth (ft):	1.45
Bankfull Cross-sectional Area (ft^2):	19.15	Maximum Bankfull Depth (ft):	2.83
Hydraulic Radius (ft):	1.28	Wetted Perimeter (ft):	14.98

Slade Run near Glyndon, Maryland

Downstream view of classification cross-section

Left bank of classification cross-section

SLADE RUN
near Glyndon, MD
U.S.G.S. Gage:1583000



Scale (ft): 0 25 50 100

Survey Date: 10/7/98
Study Reach Length: 314'

Classificaiton Cross-Section Monument Locations:

Left Monument (+/-12')	Right Monument (+/-12')
39* 29' 7.36" N	39* 29' 7.27" N
76* 47' 7.40" W	76* 47' 7.42" W
Elevation: 458'	Elevation: 460'

LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Limit of Study Reach:

WESTERN RUN AT WESTERN RUN, MD
USGS STATION NUMBER: 1583500

Latitude:	39° 30' 38"	Gage Period of Record:	1944 - Present
Longitude:	76° 40' 37"	Mean Annual Discharge (cfs):	69.70
ADC Map Coordinates:	Baltimore / 1993	Rosgen Stream Type:	C4/1
	Map 12 / C12	Survey Date:	Oct. 1997
Drainage Area (sq. mi.):	59.80		
Stream Order / Magnitude:	5 / 135		
Percent Imperviousness:	3.40		

Land Use (%): Residential: 8.79 Agricultural: 57.71 Forest: 31.88 Commercial: 1.39

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 528.00 $Q_{1.5}$: 1550.00 $Q_{2.0}$: 2134.70
(Log-Pearson Period: 1945 - 1995)

General Study Reach Description: The upstream end of the study reach is 430 feet downstream of the gage due to the Western Run Road bridge channel constriction. The reach has riffle/pool features, a bedrock-controlled meander pattern with mid-channel, point, and side bar depositional features, and some lateral scour. There are numerous pieces of large woody debris, some of which extend well into the channel, and numerous boulders throughout the reach. The bank vegetation is comprised of sycamore, walnut and ironwood trees with a moderately dense understory, while the floodplain vegetation is a mix of pasture and moderately dense forest with a moderately dense understory of sapling trees and shrubs.

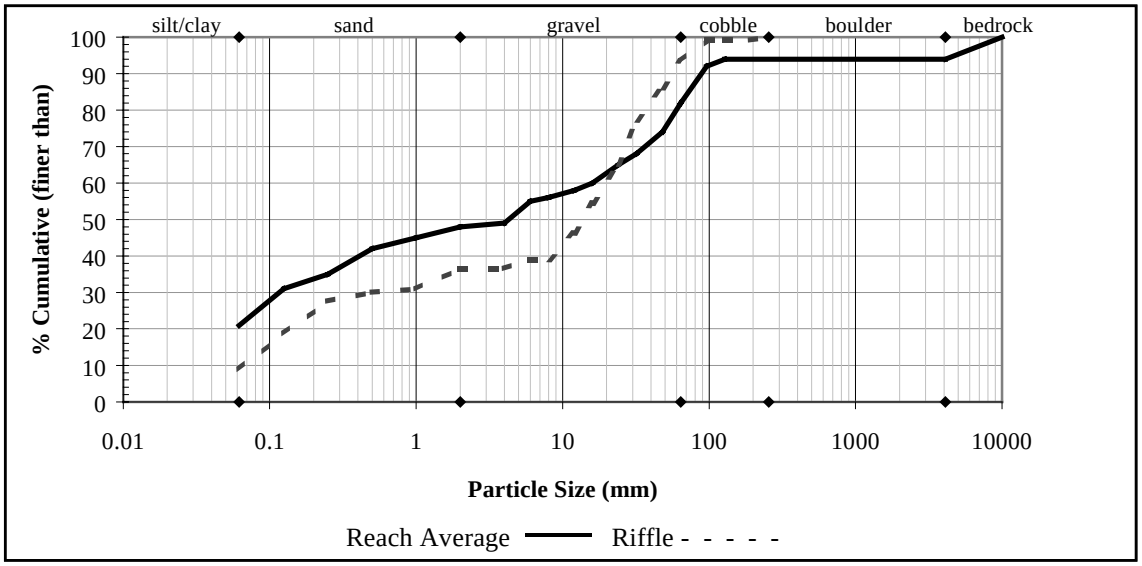
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	1531.00	Q_{bkf} / $Q_{2.0}$:	0.72	
Bankfull Return Interval (R.I.):	1.47	$Q_{Top\ of\ Bank}$(cfs):	2225.00	R.I.: 2.12
Gage Height (ft):	5.26	$Q_{Active\ Channel}$ (cfs):	666.40	R.I.: 1.03
Q_{bkf} / $Q_{1.5}$:	0.99			

STUDY REACH SURVEY INFORMATION

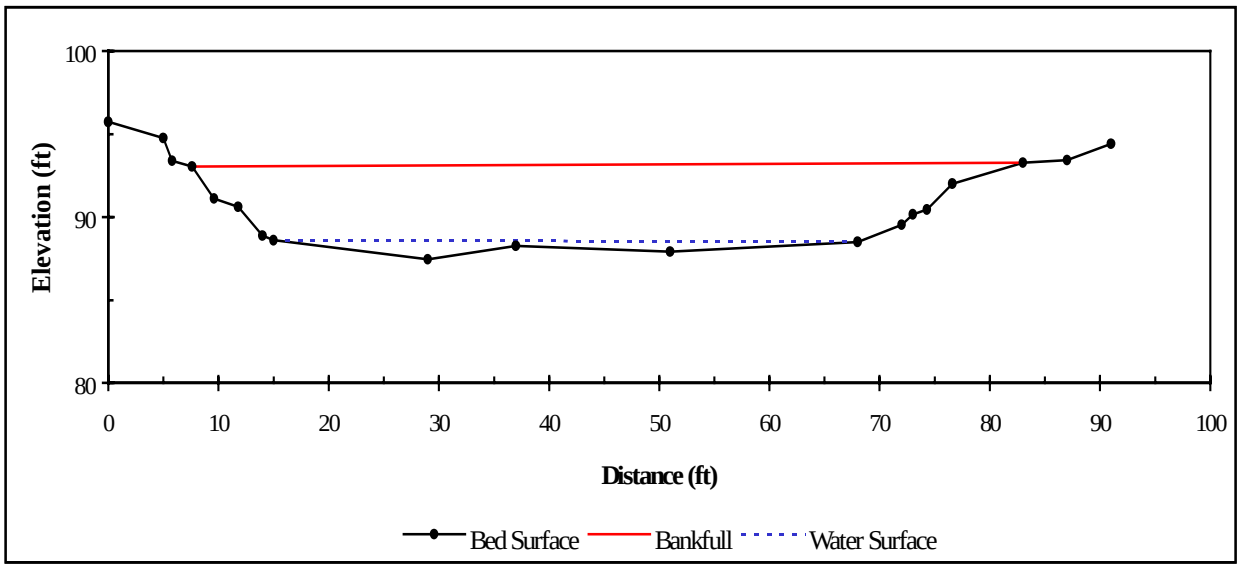
Average Water Surface Slope (ft/ft):	0.0024	Flood-prone Width (ft):	1591.00
Manning's "n":	0.038	Entrenchment Ratio:	21.10
Mean Bankfull Velocity (ft/sec):	4.88	Width/Depth Ratio:	18.13
u/u*:	8.71	Channel Sinuosity:	1.47
R/D_{84}:	28.23	Beltwidth:	600
Froude Number:	0.42	Meander Width Ratio:	8.0

WESTERN RUN AT WESTERN RUN, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	n/a	0.10
D_{35}	0.25	1.65
D_{50}	4.28	13.66
D_{84}	69.41	43.48
D_{95}	Bedrock	71.24

STUDY REACH CROSS SECTION



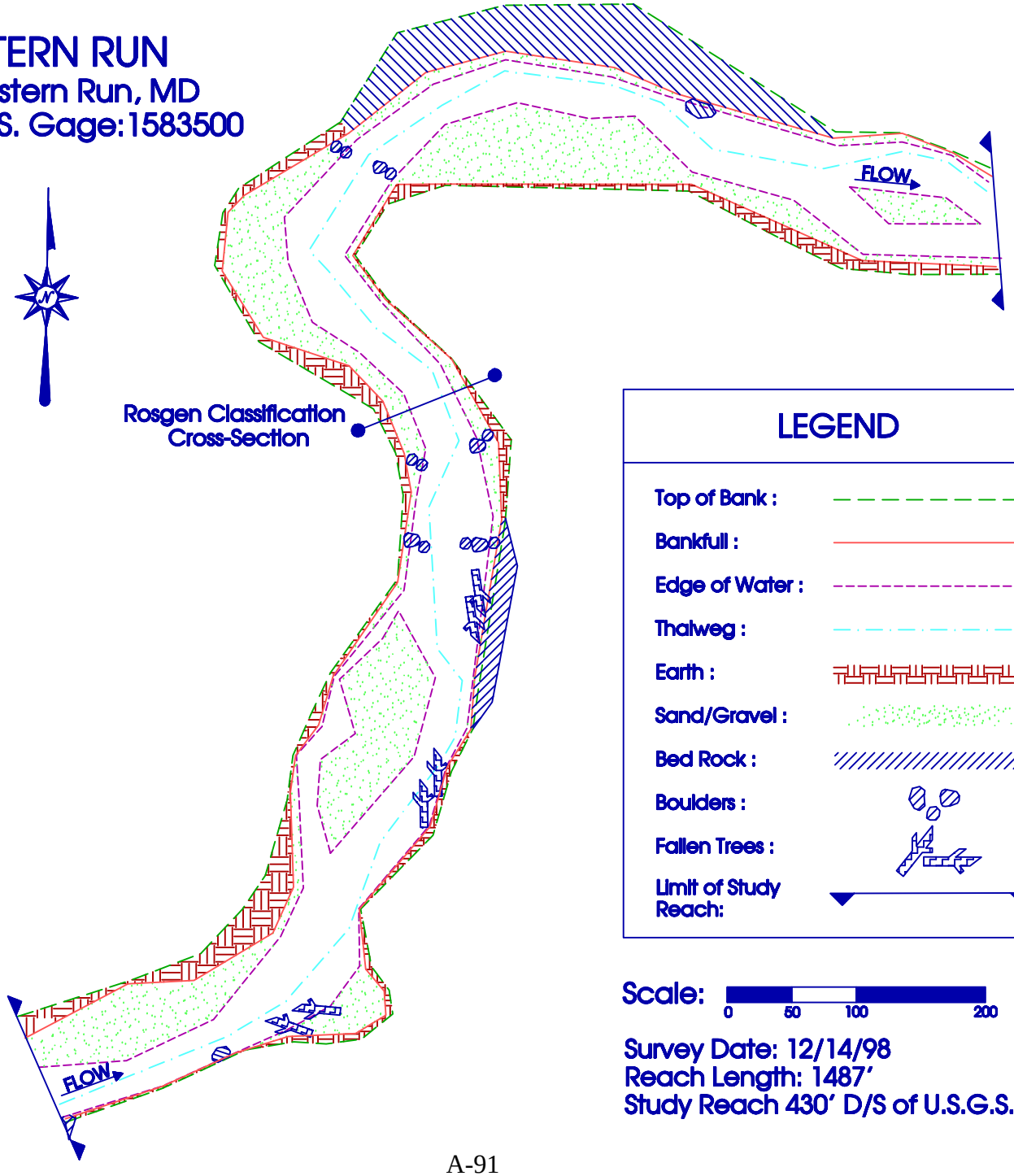
Bankfull Width (ft):	75.40	Mean Bankfull Depth (ft):	4.16
Bankfull Cross-sectional Area (ft^2):	313.81	Maximum Bankfull Depth (ft):	5.63
Hydraulic Radius (ft):	4.03	Wetted Perimeter (ft):	77.93

Western Run at Western Run, Maryland

Downstream view of classification cross-section

Right bank of classification cross-section

WESTERN RUN
at Western Run, MD
U.S.G.S. Gage:1583500



LEGEND

- Top of Bank :
- Bankfull :
- Edge of Water :
- Thalweg :
- Earth :
- Sand/Gravel :
- Bed Rock :
- Boulders :
- Fallen Trees :
- Limit of Study Reach:

Scale: 0 50 100 200

Survey Date: 12/14/98
Reach Length: 1487'
Study Reach 430' D/S of U.S.G.S. Gage

WINTERS RUN NEAR BENSON, MD
USGS STATION NUMBER: 1581700

Latitude:	39° 31' 12"	Gage Period of Record:	1967 - Present
Longitude:	76° 22' 24"	Mean Annual Discharge (cfs):	53.00
ADC Map Coordinates:	Harford / 1992	Rosgen Stream Type:	C4/1
	Map 17 / A-B11	Survey Date:	Sept. 1997
Drainage Area (sq. mi.):	34.80		
Stream Order / Magnitude:	3 / 32		
Percent Imperviousness:	7.55		

Land Use (%): Residential: 21.18 Agricultural: 47.62 Forest: 28.10 Commercial: 2.16

Log-Pearson Flood Frequency Discharge (cfs): $Q_{1.005}$: 293.10 $Q_{1.5}$: 1700.00 $Q_{2.0}$: 2487.50
(Log-Pearson Period: 1967 - 1995)

General Study Reach Description: The downstream end of the study reach is 400 feet upstream of the gage. The reach has pool/riffle features, a straight meander pattern (controlled at one point by gabion revetment) with mid-channel and side bar depositional features, and some lateral scour. There is no large woody debris in the reach. The bank vegetation is a mix of golf course fairway grass and willow/box elder thickets, with a short section of trees, predominately sycamore, red maple and alder, at the downstream end

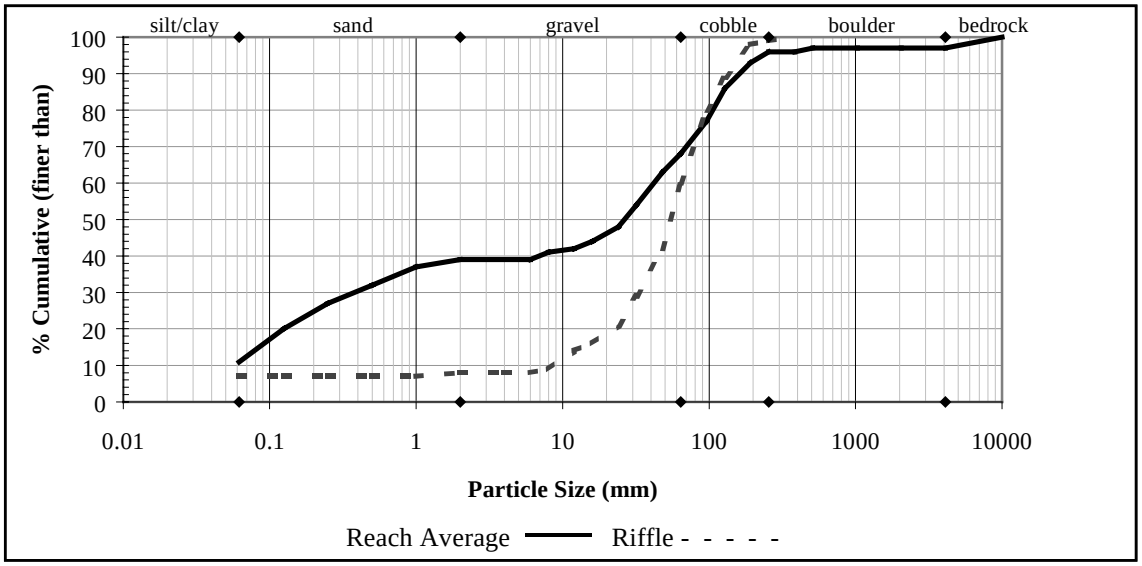
DISCHARGE BASED ON SURVEY OF GEOMORPHIC FEATURES

Bankfull Discharge (Q_{bkf} cfs):	1961.00	Q_{bkf} / $Q_{2.0}$:	0.79	
Bankfull Return Interval (R.I.):	1.65	$Q_{Top\ of\ Bank}$(cfs):	n/a	R.I.: n/a
Gage Height (ft):	5.95	$Q_{Active\ Channel}$ (cfs):	n/a	R.I.: n/a
Q_{bkf} / $Q_{1.5}$:	1.15			

STUDY REACH SURVEY INFORMATION

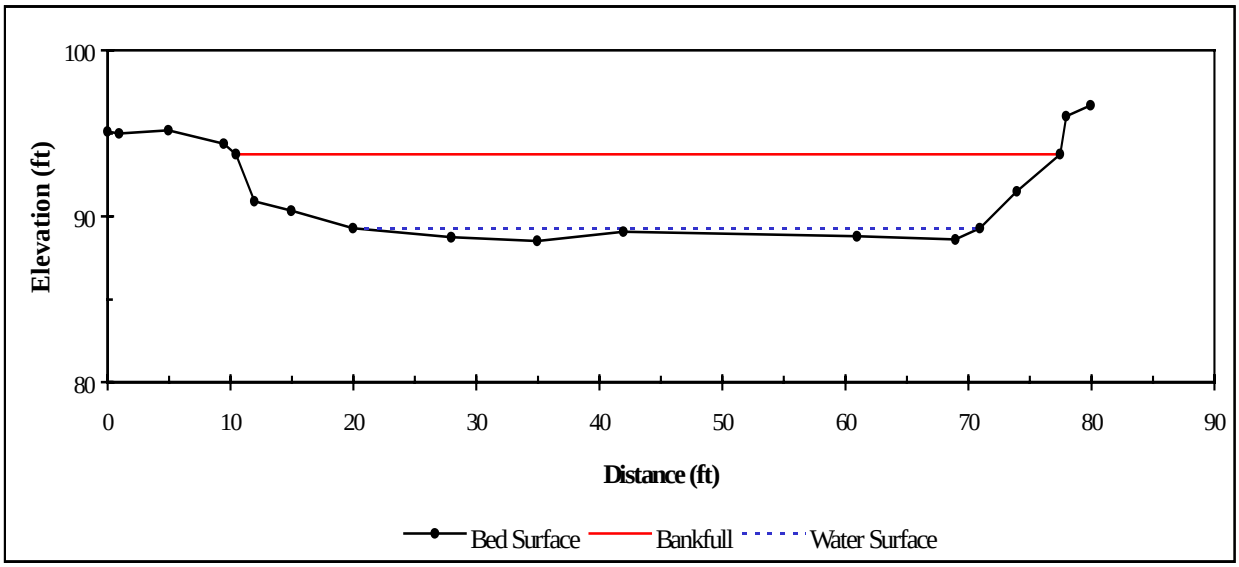
Average Water Surface Slope (ft/ft):	0.0052	Flood-prone Width (ft):	250.00
Manning's "n":	0.042	Entrenchment Ratio:	3.73
Mean Bankfull Velocity (ft/sec):	6.64	Width/Depth Ratio:	15.19
u/u*:	7.90	Channel Sinuosity:	1.14
R/D_{84}:	11.68	Beltwidth:	237
Froude Number:	0.56	Meander Width Ratio:	3.5

WINTERS RUN NEAR BENSON, MD
PARTICLE SIZE DISTRIBUTION



Particle Size (mm)		
Finer Than	Reach	Riffle
D_{16}	0.09	16.47
D_{35}	0.76	38.67
D_{50}	26.42	54.55
D_{84}	120.07	109.43
D_{95}	232.59	169.25

STUDY REACH CROSS SECTION

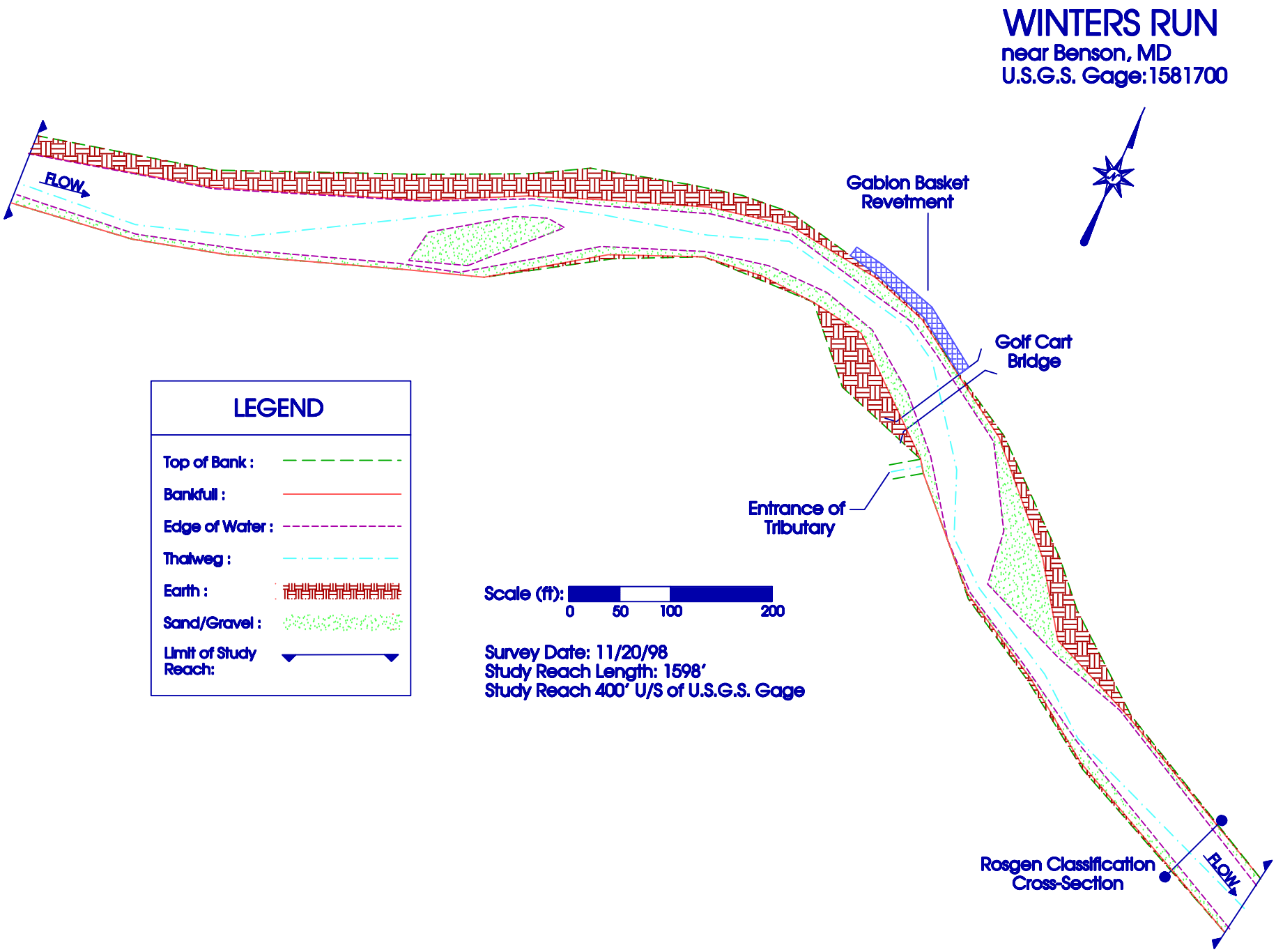


Bankfull Width (ft):	67.00	Mean Bankfull Depth (ft):	4.41
Bankfull Cross-sectional Area (ft^2):	295.54	Maximum Bankfull Depth (ft):	5.24
Hydraulic Radius (ft):	4.20	Wetted Perimeter (ft):	70.45

Winters Run at Benson, Maryland

Downstream view of classification cross-section

Left bank of classification cross-section


WINTERS RUN
near Benson, MD
U.S.G.S. Gage:1581700
FLOW
Gabion Basket
Revetment
Golf Cart
Bridge
Entrance of
Tributary
LEGEND
Top of Bank :
Bankfull :
Edge of Water :
Thalweg :
Earth :
Sand/Gravel :
Limit of Study
Reach:
Scale (ft):
0
50
100
200
Survey Date: 11/20/98
Study Reach Length: 1598'
Study Reach 400' U/S of U.S.G.S. Gage
Rosgen Classification
Cross-Section
FLOW